A Report on the
Scientific Work of the Surgical Staff
of the
Woman's Hospital
in the
State of New York
1921 - 1922

THE SIMS OPERATING THEATER
DEDICATED
TO THE MEMORY OF
JAMES MARION SIMS, M.D. LL.D.
1813 — 1883
THE FOUNDER OF
THE WOMAN'S HOSPITAL
AND
OF MODERN GYNECOLOGY
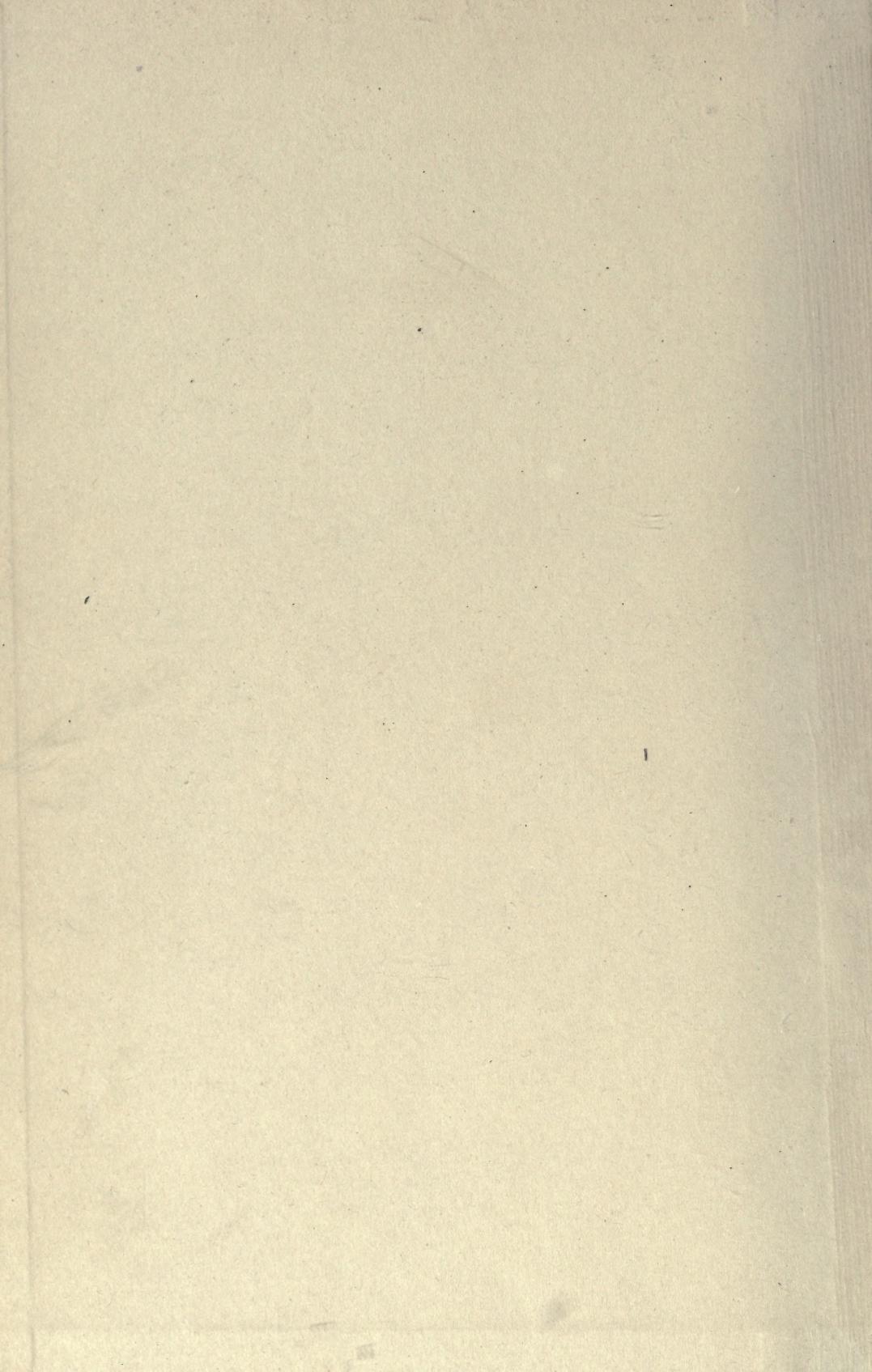
Memorial Tablet

in the

Operating Room

of the

Woman's Hospital

REPORT

OF THE

Scientific Work of the Surgical Staff

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Edited by GEORGE GRAY WARD, M.D., F.A.C.S.

VOLUME IV
1921-1922

FOREWORD

This volume of collected scientific contributions produced by the Surgical Staff of the Woman's Hospital during 1921-22 is the fourth of the series and consists of 21 monographs by the staff, and two theses by senior students of Cornell University Medical College on clinical problems assigned to them as a required part of the elective course in gynecology at the Hospital.

The entire Staff is expected to engage in clinical research and studies from our increasingly valuable records in addition to their regular work, and to publish them each year in the various scientific journals.

Through the generosity of the Board of Governors we are enabled to present them as compiled in this volume, and our sincere thanks are due them for their aid.

We also desire to express our thanks for the courtesies received from the publishers of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY; SURGERY, GYNECOLOGY AND OBSTETRICS; and the JOURNAL OF UROLOGY. Our thanks are also due to Dr. George W. Kosmak, editor of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY for his aid in facilitating the publication of the volume.

GEORGE GRAY WARD.

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DEDICATION OF THE MEMORIAL TABLET TO JAMES MARION SIMS IN THE NEW SIMS OPERATING THEATER

ON March 14, 1922, a clinic was given for the joint meeting of the Philadelphia and New York Obstetrical Societies in the newly reconstructed operating theater and on this occasion a beautiful bronze memorial tablet was unveiled and dedicated to the memory of James Marion Sims, the Founder of the Woman's Hospital. In the presence of an audience composed of the Fellows of the two Societies, the professional and nursing staff and many friends of the hospital, addresses were made by Drs. J. Riddle Goffe and Henry C. Coe, Consulting Surgeons, and by the Chief Surgeon as follows:

REMARKS BY GEORGE GRAY WARD

In my annual reports to the Board of Governors in 1919 and 1920 I called attention to the urgent need of increased and better accommodations in our surgical amphitheatre in order that we might be enabled to carry out more efficiently the important teaching function of the hospital with greater safety for our patients and more comfort to our visitors.

The old operating theater was too narrow for safe asepsis and the seating arrangements were entirely unsuited for the purpose of providing a proper view of the operations, and comfortable seats.

Through the great generosity of Mrs. Frederick Ferris Thompson, the Vice President of the Hospital, the amphitheatre has been entirely reconstructed at a cost of approximately $8,000. Formerly, no facilities were provided for the proper observation of plastic gynecological operations, as all the seats were placed at the sides of the room and a makeshift was necessary in order that a few observers could see the work. A temporary stand was placed in the window for this purpose and the visitors had to pass across the main floor of the amphitheatre in order to reach this stand, and it was necessary to place screens to protect the tables and their contents from the danger of contamination and consequent sepsis.

The remodeling of the operating theater has widened the working space by approximately six feet so that there is now no danger of contamination by overcrowding. Sixteen comfortable seats have been arranged in two tiers where the stand was formerly placed, and the marble work has been carried right across the front of these seats. A circular stairway has been provided just outside the main entrance of the theater which gives access to all the visitors' seats, so that

they do not come on to the floor of the operating room as formerly. The entire room has been repainted and the Sims memorial tablet placed over the main doors where it can be easily read by all visitors from their seats.

It seemed that the remodelling of this operating theater was a fitting opportunity to honor the memory of James Marion Sims, the founder of this hospital, by placing in it a memorial tablet reminding all who come here of the great work that he accomplished for womankind.

The story of Sims, you doubtless all know. How in Alabama during the years 1846 to 1849 he struggled to find a way to cure vesico-vaginal fistula which was so prevalent and was considered incurable. How he operated on negro slaves, keeping them at his own expense. How he toiled nearly four years before he finally succeeded in perfecting the technic of his operation so that he was able to cure these cases.

The Sims speculum which gave him the required exposure and access to the injury, the silver wire sutures which made sterile suture tracts in spite of no sterilization, the self-retaining catheter which kept the field of operation dry during the healing, are all ancient history now, but we should not forget they brought relief from well nigh intolerable suffering to scores of women who had abandoned all hope of salvation from misery in this world.

Furthermore, the success of this operation led to the development of the specialty of gynecology, which up to that time had not existed as such. Sims came to New York in 1854 and preached his crusade for the surgical relief of woman suffering from vesicovaginal fistula with the result that this hospital was founded in 1855 and for more than sixty-six years has carried on its beneficent work. The first building was opened at 83 Madison Avenue in 1855, the second in 1866 at 49th Street and Lexington Avenue, and the present buildings were opened in 1906.

Sims blazed the path and showed the way as no gynecological surgery prior to his day had made any impression on surgical practice, but no sooner was the hospital opened, as the original records show, than gynecology began to develop with amazing rapidity under the able investigations and clinical research of Emmet, Peasley, Noeggarath, Thomas, and their successors, until it has reached its present high plane in scientific medicine.

It is therefore fitting and proper that we should commemorate this man's work by the placing of this memorial tablet in this hospital, as he was its Founder and also the Founder of Modern Gynecology.

REMARKS BY J. RIDDLE GOFFE

The great advance in the art of Obstetrics through the invention of the obstetric forceps and the application of asepsis, has fortunately rendered the occurrence of vesicovaginal fistula a somewhat rare phenomenon, but unfortunately the accidents of obstetrics are still with us and afford a field for the best efforts of the gynecologist. It is so customary to associate the name of Dr. Sims with the operation upon vesicovaginal fistula that the other fields of his endeavor are apt to remain obscure and forgotten. Dr. Sims was a broader man than that and early interested himself in the abdomen as a field of operation. In his early experience he had to deal with an advanced case of abscess of the gall bladder. He recognized the emergency of the situation and unhesitatingly made an incision through the abdominal wall, instituted drainage and thereby saved his patient.

After resigning from the Woman's Hospital, in response to many urgent invitations Dr. Sims went abroad. While there busily engaged in demonstrating his operation to the surgeons of Europe in all its various capitals, the Franco-Prussian War arose. Dr. Sims at once recognized the opportunity that this would give to try out his ideas upon gun-shot wounds of the intestines. With the consent of both parties to the conflict he organized a Neutral International Ambulance for the purpose of rescuing all cases of gun-shot wound of the abdomen and submitting them to immediate operation.

As assistant ambulance surgeons he secured the services of Dr. West, a graduate of the Woman's Hospital, whom he had taken with him as his assistant; also Dr. Paul Munde, who was at that time studying in German Clinics, and others. This Neutral Ambulance found little consideration at the hands of the regular army surgeons but it did succeed in picking up a number of cases of gun-shot wound of the abdomen, and by prompt surgical interference saved many lives.

This leads up to a dramatic incident in the life of Dr. Sims. Doubtless some of you will remember the history of the shooting of President Garfield on the fourth of July, 1881. President Garfield lived for many days and was taken to Long Branch, N. J., where he could have the best of ocean air and refreshing breezes as well as the attendance of a corps of the best surgeons of the land. Finally in the course of the treatment it was reported in the morning papers that a spot of gangrene had developed in the lower right hand quadrant of the abdomen. This was also reported in the European papers. When it came to the notice of Dr. Sims he immediately cabled to the attending surgeons, "Cut down over the spot, remove bullet and drain." Not one of the

attending or consulting surgeons was willing to take that responsibility and the entire staff hastened to criticize the suggestion for its rash audacity. The patient died.

The following autumn Dr. Sims returned to America and announced to the profession that at the first meeting of the N. Y. Academy of Medicine he would read a paper in defense of the position he had taken in the Garfield case. It proved to be a great meeting, and I had the good fortune to be present and the satisfaction of coming into his presence and seeing and listening to his masterful defense. How well I remember the occasion and the man. He was rather under the average size but straight and upstanding in his bearing, with a high forehead, keen gray eye, with heavy eyebrows, and an inspiring face. Time does not permit me to go into the details of the discussion. Dr. Sims maintained his position by reciting his experience in the Franco-Prussian War and the few lives that he had saved by prompt surgical operation in gun-shot wounds of the abdomen. Not one of all the company of all the prominent surgeons who were present supported Dr. Sims in his contention. On the contrary every one denounced his attitude, holding fast to the old hypothesis that by prompt operation he was adding shock to shock and unjustifiably jeopardizing the life of the patient.

In speaking recently to Dr. John A. Wyeth about this meeting at the Academy of Medicine, he said, "I was present and walked away from the Academy with a trio of remarkable men, who discussed the paper in a friendly fashion. I heard this conversation: 'You are a brave man to advise such surgery, but the profession will never follow you.' This from Dr. James R. Wood to Dr. J. Marion Sims, who replied, 'You are all wrong, Wood. It is bound to come. You and I may not live to see it, but it will come.' Lewis A. Sayre in his earnest way, said, 'Sims, you are right.' "

Dr. Sims' suggestion was destined to bear fruit in its practical application, and, as we all know, is now the recognized surgical procedure in all cases of gun-shot wound of the abdomen if seen before they have passed the condition of possible relief.

REMARKS BY HENRY C. COE

I saw and heard Dr. Sims many years ago for the first and last time, and so vivid is my impression of that great man, that I shall simply tell you how he seemed to me.

Forty-one years ago the class in Gynecology in the old Harvard Medical School sat on the hard benches waiting for our teacher, Dr.

William H. Baker, one of the many internes of the Woman's Hospital who have brought honor to their Alma Mater. The door opened— behind Dr. Baker walked an alert, stocky man, not unlike my old friend, Dr. Goffe. Our professor introduced him as his "former teacher and Attending Surgeon, Dr. J. Marion Sims," and said that he had asked him to talk to us on a theme of his own choosing. It was the diagnosis and treatment of cancer of the cervix uteri, of which we had seen a few cases in the Clinic. We had heard of the speaker, but knew nothing of him as a pioneer in gynecology.

You are familiar with his beautiful statue in Bryant Park, back of the Public Library, with his grave, thoughtful face and rather sad expression. It represents the famous surgeon in a meditative mood. We saw him in action, with sparkling eyes, incisive speech, melodious voice, and contagious enthusiasm.

We were familiar with great men in those days, for we met daily and touched our hats to Holmes, the majestic, great-hearted Phillips Brooks, to that fine gentleman, Russell Lowell, and to the "modern John Knox," Edward Everett Hale—not realizing then that they were Immortals. The students who numbered among their lecturers Oliver Wendell Holmes, Henry J. Bigelow, Fitz, and several bright young teachers who afterward became famous, were somewhat critical, but, boys as we were, we at once recognized the fact that we were listening to no ordinary speaker.

I shall not attempt to repeat the substance of his lecture, for it would be beyond my powers, and this reminiscence is only that of a medical student. The hour passed quickly, for we were simply fascinated by his treatment of a subject now trite. The only operation for the relief of cancer of the cervix in those days was high amputation. Hysterectomy was regarded as absolutely experimental and the mortality was terrible.

The bell rang for the close of the lecture and the Professor of Obstetrics, Dr. Reynolds (the father of the present Dr. Reynolds), walked in, to be greeted with cries of "Go on! Go on!" The courteous gentleman of the old school promptly urged Dr. Sims to fill his hour also, and he did.

What lecturer before or since—and Sims never held a Chair in a medical school—could hold a class of restless students for two hours?

He bowed to us, the door opened, and he passed from our mortal vision forever.

You remember when we used to read in Virgil and Homer how the gods assumed the shapes of men and came down to talk with mortals. Their divinity was recognized only as they departed. So, in a dim way, we felt as the door closed, that we had met face to face one who was endowed with the genius which made him one of the Immortals.

PHYSIOLOGY THE BASIS OF FUTURE GYNECOLOGY*

By George Gray Ward, M.D., F.A.C.S.

Chief Surgeon

MY earliest gynecological aspirations were the result of the stimulus received from one of our Founders, Alexander J. C. Skene. Among my earliest medical memories the American Gynecological Society stands forth indelibly stamped on my mind as the apotheosis and acme of scientific acumen in all that related to the functions and disorders peculiar to women. I can well remember the awe with which I heard narrated the details of the meeting of 1892 which was held in Brooklyn. I was deeply impressed with the lofty position and scientific attainments which were a "sine qua non" to Fellowship. I am frank to state, I was fired with an ambition that some day I might aspire to become one of that select company of savants. It seems a far cry from that time to the present, and how much lower the altitude, and how much humbler our attainments appear when viewed from this end.

To attain Fellowship in our beloved Society was indeed a cherished honor; to be entrusted with the responsible and arduous duties of the Secretaryship was a mark of your confidence and trust, and became a labor of love; to become your Presiding Officer is to receive the highest honor you can bestow, and my unworthiness and its unexpectedness only serve to accentuate my deep feelings of appreciation and thanks for this signal mark of your esteem.

During the past year all of our Active Fellowship may still answer "*Adsum*," but two of our Honorary Fellows have entered into

"that sweet sleep that medicines all pain."

On June 23, 1921, Seth Chase Gordon, a former President and a Fellow since 1888, and an Honorary Fellow since 1915, passed to his eternal rest at his home in Portland Maine, in his ninety-first year; and Bennet Bernard Browne, elected to Fellowship in 1881, and an Honorary Fellow since 1912, died in Baltimore on March 10th, at the age of seventy-nine. They lived long lives of usefulness to womankind and they loved this Society which was honored by their membership. Their memories will remain as an inspiration to us.

This yearly toll that Nature exacts from our roll of elder Fellows serves but to remind us that the men who in the earlier years built the foundations of this Society on a bed rock of real scientific attainment,

a spirit of research, and irreproachable personal character, are rapidly becoming but memories. Of the thirty-nine Founders but one is alive today. Our ranks are filling with younger generations and it behooves us to take care at this stage of our existence as a Society to carefully study the history of our earliest years in order that we may fully appreciate the wisdom of our Founders and the ideals and principles upon which this Society was launched. That their wisdom was sound is proved by the fact that we are approaching our fiftieth anniversary and are in a vigorous state of health despite the storms and gloomy prognostications we have often encountered.

At this time of general unrest when the tendencies are everywhere manifest to overturn the old order of things, to push conservatism to the wall and to lean towards socialism, I believe our Society is in danger of losing its prestige and the high position which its Fellowship implies, if those who are entrusted with its guidance fail to grasp the intent of its Founders and deviate from the compass directions they laid down.

Let us glance back and study the words that have been uttered by some of the Founders relating to this matter. At the inaugural meeting for the foundation of this Society held in New York on June 3rd, 1876, Chadwick of Boston, to whose happy inspiration the Society owes its birth, said, "It has been generally conceded to be better for our Society to have a restricted membership and to require high qualification in the candidates for admission. By this means membership will come to be coveted and our discussions more profitable."

The distinguished first President of the Society, Fordyce Barker, in the first Presidential Address said, "Without insisting that our selection of members should depend solely, or even chiefly, on the literary quality of the candidate, we surely may demand that one who has acquired such a reputation as to make him a desirable member of the Society should furnish such written justification of that reputation as would merit a place in our Transactions * * * the status of this Society in the Scientific world will be determined by the character and value of the papers published in its Transactions and by the tone and ability of its discussions," and again, he warned the Fellows of the importance of care in the selection of only those who have won a right to Fellowship by a conceded personal and professional eminence, and not those who give promise as to the future,—"as they can afford to wait until time has demonstrated that the buds and blossoms of youth have developed the fruit which ripens in an established reputation with the profession at large. Honors cheapened by being made common are but slightly esteemed." He further says, "In a Society

of this kind in which Fellowship is restricted to a small number, it is of vital importance that all should be active working members."

Skene in his Presidential Address reminded the Society that it was the design of the Founders that it should be devoted to the advancement of science and art and the cultivation of the higher social elements of life and he warned against the careless selection of Fellows.

Wilson, another Founder, believed that as it was by invitation that the Society was formed, * * * that it should be by invitation continued.

Our Founders in their wisdom considered that a thesis demonstrating the fitness of a candidate should be required for Fellowship. This was a requisite for forty years, until in 1916 this requirement was done away with for supposedly good and sufficient reasons. But while it may be admitted that this requisite was often unnecessary and superfluous, and even absurd in the case of men of acknowledged preeminence, it must be apparent that it leaves a dangerous gap in our breastworks through which unqualified men may slip in should the vigilance of our sentries be relaxed. As Secretary of the Society for the preceding five years, I am in a position to state that this is no phantom peril. The plan that the Council has recently adopted of inviting as guests men who are known to have accomplished creditable work in the gynecological or obstetrical field, to present papers before the Society in order that we may judge of their suitability for Fellowship is admirable in my opinion and is in a way a substitute for the thesis. I believe that the Society would be wise to adopt this procedure as a requirement in all cases before receiving proposals for Fellowship.

Our Society has the distinction of being the pioneer national gynecological organization of the world and Fellowship is naturally regarded as the highest honor to which a rising man can attain, consequently without the thesis requirement we must be doubly careful in our scrutiny of the scientific and personal qualifications of candidates. How can we expect to carry on the spirit and high ideals of the Founders, and maintain the standard of our contributions if extraordinary care is not exercised in the selection of Fellows?

I do not agree with the idea that I have heard expressed that we should enlarge the Society and that it is our duty to lift up to higher levels the "weaker brother" by admitting him to Fellowship, and neither do I believe that it is wise to take in younger men of promise *before* they have proved themselves. As the Autocrat of the Breakfast Table well says, "Knowledge and timber shouldn't be much used until they are seasoned." I believe it is our duty to carry on the spirit of our Founders and to jealously guard our heritage against anything

tending to lower the character of the Fellowship of the Society. As Polk told us we should be "ever loyal to our forefathers, we should look to them for inspiration and guidance and ever remember our obligations to their wisdom, their courage and their fidelity, and to the trust they have passed on to us."

They blazed the trail and set the standards and ideals of the Society on a high plane. In these days when it is so easy to drift away from the old paths it is our duty to see that we do not allow the quality of our Fellowship to fall below the plane that the Founders established, in order that we may maintain for American Gynecology the proud preeminence that has already been achieved.

In previous presidential addresses you have been told of the wonderful achievements of the Society with the scalpel and in the devising of new operations and treatments, so that it would be a work of supererogation for me to remind you of them, but I cannot refrain from calling your attention to the fact that this Society has also done and is doing its share in the broader field of the general advancement of public health and welfare. In 1912 a prominent feature of the scientific program was a symposium on cancer statistics and as a result of the interest awakened by the presentations and discussions, on the motion of Dr. Reuben Peterson a committee was formed to draw up a plan of action to arouse the public to a full appreciation of this terrible scourge, and the result was the formation of the American Society for the Control of Cancer, with whose efficient work you are all familiar. The benefits of this work to mankind are comparable only to the results obtained in the world wide propaganda on tuberculosis. The American Gynecological Society has rendered a signal service to humanity in thus instituting popular education on cancer which will be the means of saving many lives.

At the present time a committee of this Society under the Chairmanship of Dr. Adair is doing valuable constructive work in cooperation with the American Child Hygiene Association in perfecting a program of maternal welfare. This work assumes great importance since Congress has passed the Sheppard-Towner Bill.

I have little patience with those who harp on the passing of gynecology as a specialty. These pessimistic harpings are but the vaporings of narrow minds who can only see cutting and sewing of the pelvic organs as the sum total of our work. As I have said elsewhere the science of medicine has become so complex with the discovery of new truths and the requirements of modern diagnostic methods and treatments, that specialization is perforce an inevitable necessity. The sister specialties of obstetrics and gynecology are interdependent and neither can be obliterated, in spite of the wishes of the general sur-

geon. As long as women continue to bear children the specialty of obstetrics cannot die, and until we reach the Utopian Age of anatomical and physiological perfection we will have reconstructive surgery to do on the female genitalia as a result of child-bearing. As well advocate the abandonment of orthopedics or urology because both fields are invaded by the general surgeon. He cannot do all there is in surgery equally well, and I believe, as in Pope's apt lines, that

"One science only will one genius fit
So vast is art, so narrow human wit."

Those who imagine that the race of gynecology as a specialty is run, should realize that during its subversion to pure surgery it was under bonds that restrained its advance by suppressing the equally important nonsurgical aspects of gynecic science. Gynecology is today throwing off the fetters which bound it to pure surgery, to its great benefit, and it is entering into a new field of a broader gynecology, which studies woman in a larger way in all her economic relations to the public weal, and which is as yet scarcely begun.

Who is better prepared than the gynecologist and obstetrician to study and promote investigations relating to women from the standpoint of the great field of state medicine in all that concerns her development, education, fitness for marriage and maternity, her evolution; and also her degeneracies as a criminal, as a pauper, or as a prostitute?

If anyone imagines that there is not sufficient work left for this Society to do in the future, let him remember that our constitution states that our objects are to promote *all* that relates to diseases of women, obstetrics and abdominal surgery. That means that in addition to the need of our studying disease and perfecting surgical technic and treatments, there is abundant work at hand waiting to be done in the perfecting of our hospital care of patients. One of the great pieces of work lying before us as a Society of leaders in surgical practice is to demand, and to show by our example, that a "surgical conscience" shall guide us in what we do for those who place their lives and future happiness in our hands. The awakening to the need for a "surgical conscience" was the result of Codman's stimulus to end result study, and the necessity has been made manifest by the nationwide movement for Hospital Standardization inaugurated by our Fellow Member and past President, Franklin H. Martin, of whose vision and achievements of organization we are justly proud. The honest auditing of our surgical results, just as our finances are audited, is the only way to make us realize our grave shortcomings in this important matter. At first thought we would all treat with indignation any

doubt as to our not giving our best judgment and care to all our patients, whether ward or private. Yet I fear that too often we are at fault in not studying our cases with sufficient thoroughness before subjecting them to the serious risks incurred by sometimes unnecessary or ill-chosen operations. That "familiarity breeds contempt" is undoubtedly true in our often careless invasion of the human organism.

I would commend to your attention Simpson's pungent criticism of our careless care of our ward patients in many instances. Greater humanity should be manifested by providing recovery wards with expert nursing, secluded and quiet rooms for the dangerously sick or dying, and competent and sufficient nurses for night duty, in order to overcome the horror of hospitals still latent in many lay minds. Hospital Standardization leads to more perfect and efficient service to our patients.

The importance of the teaching function of the hospital should not be lost sight of. In order to facilitate this, it is our duty to see that a uniform nomenclature, uniform methods of compiling statistics, and that mortality and morbidity standards are established and adopted on the lines so ably planned by Dickinson.

PHYSIOLOGY THE BASIS OF FUTURE GYNECOLOGY

While I have thus called your attention to a few of the many problems of the broader gynecology that await your solution, I would not have it thought that the field of scientific investigation relating to our obstetrical and gynecological problems is becoming exhausted. On the contrary, there is a vast field relating to our specialty, the surface of which has been barely scratched. I speak of the science of physiology in its relation to obstetrics, gynecology and abdominal surgery. As Clark has pointed out to us, in practical achievements we need fear no other nation by comparison, but that in scientific research we have left much undone. Coe urged that we give more attention to the study of pathology and prophesied that the future gynecology would aim at something more than surgical technic; and Cullen, in a recent address, states that "If America is to lead the world in surgery in the near future, every surgeon must be trained in surgical pathology."

While there can be no dispute as to the necessity and importance of our training in surgical pathology, I believe that there is certainly an equal if not greater need for our future scientific progress, and that is our appreciation and study of that vital element, the relation of physiology to surgical practice. While the study of the dead tissues is of vast import in developing our knowledge of disease, we should not forget that we are daily dealing with live tissues, and I am convinced

that the future development of our specialty lies in our increasing interest in physiology. E. P. Davis has well said, "A new cellular pathology is yet to be written from the standpoint of cellular metabolism." It is still true that the physiology of the female pelvic organs is so little known that all its essentials have yet to be studied. Our patients have had their pathology studied for years in the specimens removed from their bodies, but it is only in recent years that more attention is being paid to preoperative physiological conditions. We do not yet see, however, intraoperative and postoperative physiological studies made with sufficient frequency. We as yet know little or nothing about what is going on in this living biochemical laboratory during the time of operation, or during the actual processes of childbearing. Beyond recording the pulse and respirations, and perhaps the blood-pressure, we have been content to consider that we have all the knowledge necessary. The chemical and physical changes produced in the blood and its containers, in the great nerve centers, and in the ultimate cells, by anesthesia, trauma of operation, hemorrhages, liberation of toxins, etc., are waiting to be revealed. We simply put our patients to bed after operation and expect them to get well as a matter of course and only record the temperature, pulse and excretions. If peritonitis or embolism develop we throw up our hands in our helplessness, for we have yet to find the cure for these great curses that still too frequently overshadow our surgery, and that often when we least expect it blast our successful results with the blight of death.

Our further understanding of our many unsolved problems lies in our acquiring biochemical knowledge as was so admirably called to our attention last year by Blair Bell. Bayliss, the great English physiologist, says, "As physiologists our task is to refer, as far as we can, all phenomena of life to the laws of physics and chemistry." Through experimental biology and biochemistry will be elucidated the laws of what is normal in our bodies, and how these laws may be disturbed or altered by anesthesia and operative procedures as well as by disease. We recognize today that the human body is a vast chemical factory in which complex chemical and physical reactions are constantly occurring. A disturbance from their normal functioning means disease. Invading microorganisms produce their destructive work by chemical agencies, their toxins poisoning the vital centers.

In the protoplasm of the ultimate cell, chemical reactions take place which determine health or disease. Haldane, the physiologist, states that, "There is a constant molecular interchange between the cell and its environment. Cell secretion, cell respiration, and cell nutrition are

clearly only different aspects of the same whirl of molecular activity.'' The study of the blood and its circulation is a vast field that is of vital interest to us in its practical relation to our daily operative work. As socially it is asked how blue the blood is, so surgically it should be asked how red it is, for upon the state of the blood may largely depend the operative risk. This means not only the investigation as to the amount of hemoglobin and the number and proportion of the cells, but also its coagulability, viscosity, CO_2 combining power as a measure of possible acidosis, the state of the blood cells, and the tone of the vessels.

How many surgeons do we see studying blood pressure before and after operation as a routine? How many know what the expected fall in pressure should be after an operation of a certain severity, and what are the limits of safety? How many know how high a preliminary rise in blood pressure in the preoperative excitement stage may be safe for a patient who already has a high blood pressure? What is the normal rise in leucocytes after a clean operation? The importance of Walters' recent studies in the Mayo Clinic relating to the coagulation time of the blood and the effect of calcium chloride in shortening the time is an example of a physiological study that directly interests us as surgeons. The effect of anesthesia on the blood and the introduction of various solutions and colloidal suspensions directly into the circulation opens up a large field for fruitful observations. Studies of blood chemistry should be made in peritonitis. Opie has already determined that carbohydrates act in a protective manner.

The elucidation of many obscure problems of surgery relating to diabetes, nephritis, acidosis, and the possibility of traumatic toxemia being a factor in surgical shock, must be solved by the physiologist and biochemist. He may also aid us in our studies on the mystery of thrombus formation, and the control of the formation of peritoneal adhesions. Williams pointed out to us that we had done nothing in the way of the biological or biochemical aspects of pregnancy, or of the normal metabolism of pregnancy and the puerperium of involution. The causation of the onset of labor and the physiology of uterine contractions awaits us, as do the etiology of abortion and the toxemias of pregnancy. Indeed, the need of biochemical and physiological research in the obstetrical field is a reproach to us. Kosmak, in the Report to this Society of the ''Special Committee on Research Work,'' in 1920, called our attention to our responsibilities as a national Society made up of leaders, in promoting obstetrical research and in taking our part in solving the more general sociological problems affecting the future welfare of mankind. How may we best accomplish this desirable end? I must admit that the task I have outlined pre-

sents many difficulties. First, there is the need of adequate laboratory facilities for making biochemical and physiological studies in close conjunction with our operating rooms and wards. Many of our hospital laboratories while equipped to make routine examinations are not prepared to carry out research work of the type required. Next and most difficult is to find biochemists and physiologists to aid us in this work. There are very few men so trained who are available and they are largely absorbed by the university laboratories.

What we need in our daily clinical research problems are the services of a physiological chemist available in our hospital laboratories, who will study these vital problems with us as they occur in our patients in the operating room as well as in the wards. We as clinicians are as necessary to them as they are to us in collaborating in this research if practical results are to be obtained. Erlanger, whose studies in postoperative shock and hemorrhage are familiar to us all, has lamented his inability to carry out certain researches on account of the lack of opportunity to apply his work clinically in our hospitals.

To provide the physiologists and the necessary laboratory facilities means a considerable expenditure of money, more than many hospital trustees may feel able to meet at the present time, but as they have been brought to see the necessity for a pathologist and an efficient laboratory as an essential part of every hospital today, so in the near future we may hope that they may be made to appreciate the need of a physiologist with biochemical equipment as a necessary part of the resources of every hospital which expects to further medical knowledge. At the Rockefeller Institute in New York and elsewhere such biochemical studies are being carried out at the present time largely on important medical problems, and the extent of their work must necessarily be limited by the number of available hospital beds at their disposal. Our many surgical hospitals have a vast material awaiting to be studied.

Here lies a great opportunity for the Rockefeller, Carnegie, and other Foundations that are interested in the advancement of medical knowledge, to make use of this vast clinical material in our surgical wards for biochemical study, by providing such research workers and the necessary equipment to hospitals that are desirous of carrying on scientific work of this kind. I know that I would be very glad to see the Woman's Hospital in New York make use of such an opportunity.

As the future of gynecology and obstetrics lies in the broad field of physiological research, what is more fitting than that this national Society of men preeminent in the specialty, should show the way? What would more truly carry out the wish of the founders? They were early interested in physiological studies. At the first meeting in

1876 a letter was read from Dr. John C. Dalton, Professor of Physiology in the College of Physicians and Surgeons of New York, asking the cooperation of the Fellows in studies he was making of the corpus luteum, and at the second annual meeting he rendered an exhaustive report of the results of his observations, and he was made an Honorary Fellow.

Our fiftieth year is approaching and we must soon consider the means of an appropriate celebration of that auspicious event. Who shall dare say that the achievements of the past half century will not have more than justified our *raison d'etre?* Are we to weep like Alexander because we have no more worlds to conquer? We know that the first gleam of organized science in the world was due to Aristotle who anticipated the modern scientific movement in his realization of the importance of ordered knowledge, yet do we realize that it is only seventy generations to the time of Philip of Macedon when Aristotle lived, and that it is seven hundred generations to our cave men ancestors? The evolutionary processes move slowly and the ultimate perfection we may hope to attain is yet far off. Surely, we have done well in the short time of our existence as a Society, but we have scarce begun, and when we remember that great men in the past history of science have considered that they have spoken the last word on many problems which in the light of our present knowledge seems absurd, how dare we say that our work is finished?

The American Gynecological Society has a heritage of work accomplished to be proud of, its Fellows have explored the unbeaten paths in the past and shown the way to successful abdominal surgery. It is now time for them to still show the way in these new fields of exploration.

Truly our work is not yet finished, and as is so well expressed in the words of James Russell Lowell's beautiful hymn,—

> "New occasions teach new duties;
> Time makes ancient good uncouth;
> They must upward still and onward
> Who would keep abreast of Truth."

48 East Fifty-second Street.

VOMITING AND DISTENTION AFTER LAPAROTOMY LESSENED BY THE SUBSTITUTION OF RUBBER ENVELOP PADS FOR GAUZE*

INFLUENCE OF ETHER, MORPHINE, AND RECTAL THERAPY

BY DOUGAL BISSELL, M.D., F.A.C.S.

Attending Surgeon

THE primary object of this study was to find out what differences, if any, existed in postoperative emesis and intestinal distention between laparotomized cases in which rubber envelop pads were used and those in which gauze pads were used.

The operations were intraabdominal and, with a few exceptions (namely, appendectomies, intestinal resections, and ventral herniæ), were performed upon the pelvic organs of the female. In many cases, plastic work of the vaginal canal was done in combination with the abdominal work. The character of the operations was, therefore, practically the same. Simple appendectomies, when done through the McBurney or right rectus incision, were not included for the reason that here little use was made of pads, and consequently but a limited amount of trauma was inflicted on the peritoneum of the intestines.

It was originally proposed to study 800 laparotomized cases. In 400 of these, rubber envelop pads were used; in 400, gauze pads were used. The former cases were operated on between November 26, 1917, and January 13, 1920, and the latter between December 20, 1917, and July 15, 1920. But after completing the study in greater part, it was discovered that of the three operators who were credited with the use of gauze pads, one not infrequently used rubber pads, and, as it could not be determined in which cases the gauze pads were used, it was necessary to eliminate 34, making a study of 366 cases in which gauze pads were used, and 400 in which rubber pads were used. As this study was made primarily to determine the difference in action and influence of rubber and gauze used intraabdominally with respect to postoperative emesis and distention, it was necessary to exclude all cases of general septic peritonitis, as emesis and distention are almost invariable sequelæ to this pathology.

The study was limited to the first 3 days of convalescence, because cathartics, which are usually administered on the fourth day, are not infrequently responsible for emesis, and because distention from

operative causes unless the result of sepsis, seldom extends beyond the third day.

The operative technic of one group of cases differs radically from that of the other in one particular only, namely, in the character of the abdominal pads used.

The postoperative care differed in several minor features, namely, in regard to rectal therapy and the degree of tension of the abdominal binder. Pre-operative care was practically the same in all cases with respect to the amount of morphine and atropine administered before etherization.

The group in which rubber envelop pads were used will be designated as group 2; the group in which gauze pads were used will be designated as group 3. As the comparative study will be made with regard to the days on which emesis or distention occurred, these groups will be divided according to days. Classified according to this plan, it was found that the cases fall into eight divisions:

The first division includes those cases which did not vomit at any time during the first 3 days of convalescence;

The second division includes those cases which vomited the first day only (that is, the day of operation);

The third division includes those cases which vomited the first and second days only;

The fourth division includes those cases which vomited during the first, second, and third days;

The fifth division includes those cases which vomited the first and third days only;

The sixth division includes those cases which vomited the second and third days only:

TABLE I

GROUP I. NONLAPAROTOMIZED 300 CASES

| | EMESIS RECORD DAYS OF CONVALESCENCE | | | NO. OF CASES | PERCENTAGE IN |
DIVISIONS	1ST	2ND	3RD	IN EACH DIVISION	EACH DIVISION
1	0	0	0	80	26.7
2	x	0	0	208	69.3
3	x	x	0	5	1.7
4	x	x	x	3	1.0
5	x	0	x	1	.3
6	0	x	0	0	.0
7	0	x	0	2	.7
8	0	0	x	1	.3
Total............................300					100.0

x Indicates the day or days on which one or more emesis occurred.

The seventh division includes those cases which vomited during the second day only;

The eighth division includes those cases which vomited during the third day only.

It was a simple matter to determine the frequency and duration of emesis in groups 2 and 3, but an analysis of them, with the object of determining why there were such great variations in emesis with respect to days, and of differentiating between emesis, the result of ether, and emesis, the result of other causes, was found impossible until the limits of the influence of ether, morphine, and other factors were known. Therefore, it became necessary to study another group of cases, those in which all causative factors arising from peritoneal invasion were eliminated. This group will be known as group 1, the nonlaparotomized cases (Table I).

Of the 300 cases constituting group 1, 80, or 26.7 per cent, did not vomit during the first 3 days of convalescence; 208, or 69.3 per cent, vomited during the first day only, and 12, or 4 per cent, vomited during and after the first day or only after the first day.

To facilitate the study of group 1, I have divided it into subgroups *a* and *b*. Subgroup *a* consists of those cases which were under the influence of ether more than 1 hour (Table II). Subgroup *b* consists of those cases which were under the influence of ether less than 1 hour (Table III). The former includes 200 cases with extreme limits of time—1 hour to 3 hours 10 minutes; the latter includes 100 cases with extreme limits—15 minutes to 1 hour.

An analysis of subgroup *a* with respect to the time of etherization, and the time limit of postoperative emesis shows:

TABLE II

SUBGROUP *a*. NONLAPAROTOMIZED CASES; TIME OF OPERATION MORE THAN ONE HOUR: 200 CASES

DIVISIONS	EMESIS RECORD DAYS OF CONVALESCENCE			NO. OF CASES IN EACH DIVISION	MINUTES	PERCENTAGE IN EACH DIVISION
	1ST	2ND	3RD			
1	0	0	0	50	100	25.0
2	x	0	0	140	95	70.0
3	x	x	0	5	—	2.5
4	x	x	x	2	—	1.0
5	x	0	x	1	—	.5
6	0	x	x	0	103	.0
7	0	x	0	1	—	.5
8	0	0	x	1	—	.5
Total.........................200						100.0

x Indicates the day or days on which emesis occurred one or more times.

The average time of etherization in the 50 cases constituting division 1 was 1 hour, 40 minutes;

The average time of etherization in the 140 cases constituting division 2 was 1 hour 35 minutes;

The average time of etherization in the 10 cases constituting divisions 3, 4, 5, 6, 7, and 8 was 1 hour 43 minutes.

A further analysis shows that of the 50 cases constituting division 1, etherization lasted 2 hours or more in 12 cases with an average time of 2 hours, 24 minutes, and that in the remaining 38 cases of this division etherization lasted between 1 and 2 hours, with an average time of 1 hour, 22 minutes.

That of the 140 cases constituting division 2 etherization lasted 2 hours or more in 30 cases with an average time of 2 hours, 10 minutes, and that in the remaining 10 cases of this division etherization lasted between 1 and 2 hours with an average time of 1 hour, 24 minutes.

This analysis shows—

First, that the average time of etherization in the cases which did not vomit at any time was not shorter but 5 minutes longer than in the cases which did vomit during the first 24 hours only.

Second, that the average time in the 12 cases under ether 2 hours or more, which did not vomit, was 14 minutes longer than that of the 30 cases under ether 2 hours or more but which did vomit during the first 24 hours.

Third, that the average time of the remaining 38 cases etherized between 1 and 2 hours which did not vomit was 2 minutes less than

TABLE III

SUBGROUP b. NONLAPAROTOMIZED CASES; TIME OF OPERATION LESS THAN ONE HOUR; 100 CASES

	EMESIS RECORD DAYS OF CONVALESCENCE					
DIVISIONS	1ST	2ND	3RD	NO. OF CASES IN EACH DIVISION	MINUTES	PERCENTAGE IN EACH DIVISION
1	0	0	0	30	27	30.0
2	x	0	0	68	30	68.0
3	x	x	0	0	—	.0
4	x	x	x	1	—	1.0
5	x	0	x	0	—	.0
6	0	x	x	0	22	.0
7	0	x	0	1	—	1.0
8	0	0	x	0	—	.0
Total.....................100						100.0

x Indicates the day or days on which one or more emesis occurred.

that of the 10 cases etherized between the same hours but which did vomit.

As there are only 10 cases in the remaining divisions which vomited irregularly with regard to days it is difficult to make a satisfactory comparative study of them. We find, however, that the emesis which occurred in these cases after the first day, was the result,

in the majority of cases, of such causes as food and medicine admin-
istered immediately before emesis.

Two of these cases, therefore, might be classified in division 1; eight
of them might be classified in division 2. Under this readjustment
the average time of division 1 would be 1 hour 37 minutes, and that
of division 2, 1 hour 36 minutes.

These findings would suggest that the element of time as a causa-
tive factor in postoperative emesis is not so important as we have
heretofore been led to believe.

An analysis of subgroup *b* with respect to the time of etherization,
and the time limit of postoperative emesis shows:

The average time of etherization in the 30 cases constituting divi-
sion 1 was 27 minutes;
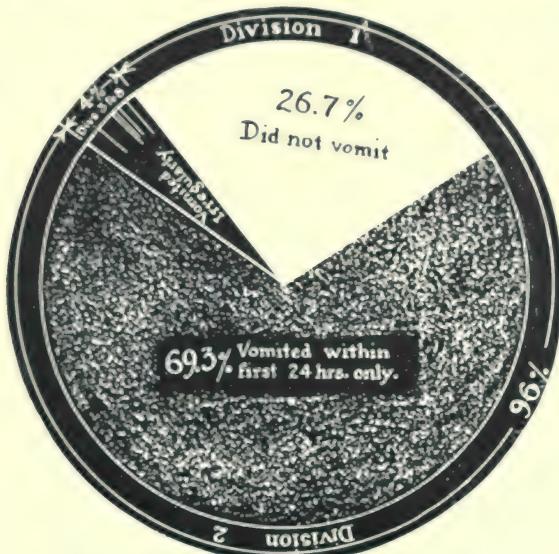
Fig. 1. Group 1. Nonlaparotomized cases.

The average time of etherization in the 68 cases constituting divi-
sion 2 was 30 minutes;

The average time of the remaining 2 cases constituting divisions
4 and 7 was 22 minutes.

A further analysis shows—

That of the 30 cases which constituted division 1, etherization lasted
from 30 to 55 minutes in 13 cases, with an average time of 39 min-
utes, and that in the remaining 17 cases of this division etherization
lasted less than 30 minutes;

That of the 68 cases which constitute division 2 etherization lasted,
in 38 cases, from 30 to 57 minutes, with an average time of 37 min-
utes. In the remaining 30 cases of this division, etherization lasted
less than 30 minutes, with an average time of 20 minutes.

This analysis shows—

First, that the average time of etherization, in the cases which did not vomit at any time, was 3 minutes shorter than that in the cases which did vomit during the first day.

Second, that the average time in the 13 cases under ether between 30 and 55 minutes, which did not vomit, was 2 minutes longer than that in the 38 cases under ether the same length of time but which did vomit during the first day.

Third, that the average time of the remaining 17 cases etherized less than the 330 minutes, which did not vomit, was only 1 minute less than that of the 30 cases etherized the same length of time but which did vomit during the first day.

Of the two cases which vomited irregularly with regard to days, one vomited on each of the 3 days and was etherized 30 minutes. The other vomited on the second day only and was etherized 15 minutes. Accidental causes were determined immediately preceding the emesis which occurred in these cases on the second and third days. The first case might, therefore, be classified with division 2, and the second case with division 1; but as these cases constitute so small a part of the entire group and as the length of their respective etherization could alter but little the percentage of the divisions, they might be disregarded entirely.

It would, therefore, seem that regarding the relationship between the duration of etherization and frequency or infrequency of emesis, there is no fixed rule.

TO WHAT EXTENT DOES MORPHINE ADMINISTERED HYPODERMATICALLY AFTER OPERATION ENTER AS A CAUSATIVE FACTOR IN POSTOPERATIVE EMESIS?

An analysis of the divisions in group 1—nonlaparotomized cases— shows the following:

Of the 80 cases with no vomiting, we find that 40 received morphine during the first day; as no emesis occurred on this day, these 40 cases which received morphine acted, with respect to emesis, as did the remaining 40 cases which did not receive morphine. The total amount of morphine given these 40 cases was a fraction less than 16 grains or an average of 0.4 of a grain.

On the second day, we find that 26 cases received morphine. As no emesis occurred on this day, the 26 cases which received morphine acted in no way differently with respect to emesis than did the remaining 53 cases which received no morphine. The total amount of morphine given these 26 cases was a fraction less than 8 grains or an average of 0.3 of a grain.

On the third day, we find that 10 patients received morphine. As

no emesis occurred on this day, these 10 patients acted, with respect to emesis, as did the remaining 69 cases in which no morphine was administered. The total amount of morphine given these 10 patients was 3 grains or an average of 0.3 of a grain.

Of the 208 cases vomiting on day of operation (division 2), we find that 134 cases received morphine during the first day. As emesis occurred on the first day in all cases of this division, the remaining 74 cases vomited independently of the possible influence of morphine acting as a causative factor in emesis. Of the 134 cases which received morphine, 53 vomited before its administration, 49 vomited after, and 32 vomited before and after. The total amount of morphine given these 134 cases was 52 grains or an average of 0.4 of a grain.

On the second day, we find that 79 patients received morphine. As no emesis occurred on the second day of this division, these 79 cases which received morphine acted in no way differently, with respect to emesis, than did the remaining 129 cases which received no morphine. The total amount of morphine administered to these 79 cases was 29 grains or an average of 0.3 of a grain.

On the third day, we find that 40 patients received morphine. As no emesis occurred on the third day of this division, these 40 cases acted in no way differently, with respect to emesis, than did the remaining 168 cases which received no morphine. The total amount of morphine administered to the 40 cases was 11 grains or an average of 0.3 of a grain.

It would, therefore, appear from this analysis that of the 174 cases not vomiting at all or vomiting the first day only (divisions 1 and 2), which received morphine during the first day, only those cases which vomited after its administration, namely 49, and those cases which vomited before and after, namely 32, totaling 81, could have been influenced by morphine with respect to emesis.

As the average amount of morphine (i.e., 0.4 of a grain) administered to these 81 cases which vomited was no greater, but identical, to the average amount given to the 93 cases which did vomit, and as the average amount (i.e., 0.3 of a grain) administered on the second day to the 105 cases and on the third day to the 50 cases were identical, it would seem reasonable to conclude that the amount of morphine administered hypodermatically after operation exerted but a minor influence, if any, as a factor in postoperative emesis.

Of the 12 cases, constituting 5 of the remaining 6 divisions, we find that 9 cases received morphine during the first day and three did not. Of the 9 cases, 8 vomited on that day and 1 did not. Of the 8 cases, 2 vomited after, and 6 vomited before and after, the administration of morphine. The case which did not vomit received a

larger dose of morphine during the first day than did any of the cases which vomited. The total amount of morphine given the 8 cases which vomited was 4 grains or an average of 0.5 of a grain. Of the 3 cases which received no morphine on the first day, 1 vomited seven times, and 2 did not vomit.

Of the 7 cases which received morphine on the second day, we find that 5 vomited and 2 did not. Of the 5 cases which vomited, the cause of emesis in 4 could be traced to food or medicine administered by mouth. To the remaining 2 cases which did not vomit, the smallest individual amount of morphine was administered. Of these cases, 1 received the largest individual amount of morphine administered on the second day to any of the 12 cases constituting 5 of the remaining 6 divisions. The total amount of morphine administered to the 7 cases was 1.7 grain or an average of $\frac{1}{4}$ grain.

On the third day, we find that 3 cases received morphine. Of these only 1 vomited. This is the case previously noted as having received the largest amount of morphine on each of the first 2 days without emesis following. But on this, the third day, it received the smallest amount of morphine administered during the 3 days. There is every reason to believe, however, that emesis did not occur then as the result of morphine but as the result of the administration of magnesium sulphate which it immediately followed.

It would therefore seem that, regarding the relationship between the amount of morphine administered and the frequency or infrequency of emesis, there is no fixed rule.

While a very considerable number of individual cases could be related to sustain both conclusions formed by the previous study of averages regarding the relationship between ether and emesis, and morphine and emesis, it has been deemed undesirable to include these as in the study of individual cases, idiosyncrasy to drugs, which is an indeterminable factor, must enter.

IS THERE A FIXED RELATIONSHIP BETWEEN THE AMOUNT OF ETHER AND THE TIME OF ITS ADMINISTRATION?

It is to be regretted that the amounts of ether administered to the cases in group 1—nonlaparotomized cases—were not sufficiently often recorded to permit of an exact estimate of the average amount administered per hour.

In subgroup a, those over 1 hour, there were 93 cases recorded with an average amount per hour of 176 c.c.; in subgroup b, those under 1 hour, there were only 15 cases with amount of ether recorded, averaging per half hour 135 c.c. This comparison would make it appear that the average amount of ether administered is greater during a short anesthesia than during a long one.

There was noted in the hands of only one anesthetist a somewhat constant relationship between the two elements—the amount of ether and time of administration—but in this instance the number of cases was too few to be of value in forming a conclusion.

TIME LIMIT OF POSTOPERATIVE EMESIS AND THE LIMIT OF THE INFLUENCE OF ETHER WITH RESPECT TO EMESIS

Our immediate concern in this last analysis of group 1, nonlaparotomized cases, is in regard to the limit of postoperative emesis and the predominant causative factor of emesis. As peritoneal trauma is not present in this group, it offers the best opportunity to study the limit of influence of any element, common to all groups, which might enter in causative relationship to emesis.

Such causative factors of emesis as food and medicine administered by mouth, acidosis, gastric accumulations, etc., act occasionally and may be considered accidental, but ether in the blood is the only possible factor which may be considered as constant.

Though ether as a possible factor is constant, one or more of the accidental factors may at times act independently or with it; therefore, it is not always possible to determine when emesis is the result of a single factor. A fairly accurate conclusion may, however, be arrived at in determining the predominating causative element of emesis in this group by an analysis of the duration of emesis with respect to hours and a study of immediate or accidental causes.

If in a very large percentage of cases, the limit of postoperative emesis should fall within a period during which certain accidental factors are not usually present, this fact would be suggestive of the predominating influence of the factor known to be constant.

An analysis of group 1—nonlaparotomized cases—shows that 80 cases, or 26.7 per cent, were not influenced with respect to emesis by any probable causative factor; that in 208 cases, or 69.3 per cent, emesis occurred during the first 24 hours only, and that in but 12 cases, or 4 per cent, did emesis occur after the first 24 hours.

In the 208 cases which vomited during the first day only, there doubtless existed more than one causative factor of emesis, but whatever they were and how many there may have been, their limit of influence did not exceed 24 hours. However, of the possible factors, ether alone was constant; therefore, it would seem reasonable to consider it the dominant factor in the causation of emesis during this period. Further, that, as the limit of emesis in these 208 cases did not exceed 24 hours, we may reasonably suppose that the limit of the influence of ether with respect to emesis does not exceed the first 24 hours.

Of the 12 cases in which emesis occurred after the first day, acci-

dental causes, such as food and medicine by mouth, were discovered on the second and third day in 9; in the remaining 3 cases no immediate or accidental cause of emesis was determined. Of the 9 cases, 2 did not vomit on the first day, and 7 did. Because of the fact that accidental causes of emesis were determined after the first day in these cases, the former might be included in division 1 and the latter in division 2. If so considered, the total number of cases which vomited during the first day only, and from other than known accidental causes, would increase from 208, or 69.3 per cent, to 217, or 72.3 per cent. In the remaining 3 cases in which no accidental cause was discovered to account for emesis occurring after the first 24 hours, the limits of emesis were as follows: first case, 26 hours after operation;
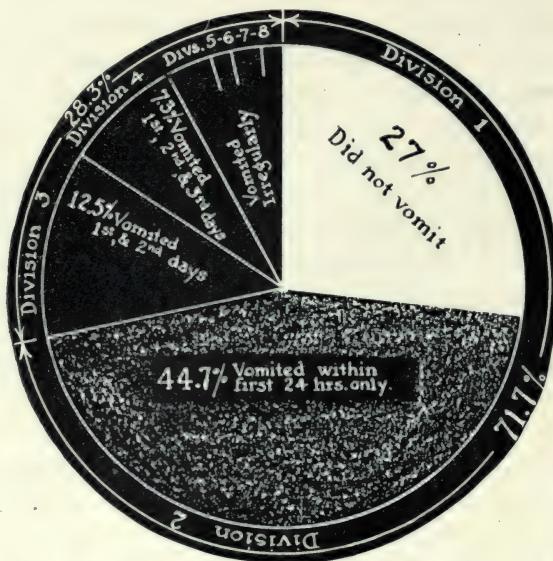
Fig. 2.—Group 2.   Cases in which rubber envelop pads were used.

TABLE IV

RATING OF ANESTHETISTS

ANESTHETISTS	NUMBER OF CASES	PERCENTAGE OF CASES WHICH DID NOT VOMIT	PERCENTAGE OF CASES WHICH DID VOMIT
No. 1	18	66.6	33.4
No. 2	23	47.8	52.2
No. 3	16	44.0	56.0
No. 4	55	36.4	63.6
No. 5	79	29.0	71.0
No. 6	54	23.8	76.2
No. 7	36	14.0	86.0

second case, 30 hours after operation; and the third case, 39 hours after operation. The emesis which occurred 39 hours after opera-

tion in the third case was the only emesis which occurred in this case during the entire time of convalescence.*

A list showing the rating of the anesthetists who administered ether more than 10 times is given in Table IV.

Anesthetists' numbers 1, 2, and 3, though showing a comparatively high percentage of cases which did not vomit, had fewer cases by less than half than numbers 4, 5, and 6.

One of the group, namely, number 7, showed a much higher percentage of cases vomiting than the others. This single instance raises the question regarding the individual skill of the anesthetist as a factor in limiting emesis, but the rating of no anesthetist can be determined under 50 or 100 cases.

Ether was administered to the remaining 19 cases by 6 other anesthetists.

CONCLUSIONS REGARDING NONLAPAROTOMIZED CASES

1. In 300 successive nonlaparotomized cases, etherized, over 26 per cent escaped vomiting altogether; nearly 70 per cent vomited only in the first 24 hours, and 4 per cent vomited irregularly.

2. The length of etherization has no relationship to postoperative emesis with respect to frequency or days of occurrence.

TABLE V

GROUP 2.   LAPAROTOMY WITH RUBBER ENVELOP PADS; 400 CASES

| | EMESIS RECORD DAYS OF CONVALESCENCE | | | NO. OF CASES | PERCENTAGE IN |
DIVISIONS	1ST	2ND	3RD	IN EACH DIVISION	EACH DIVISION
1	0	0	0	108	27.0
2	x	0	0	179	44.7
3	x	x	0	50	12.5
4	x	x	x	29	7.3
5	x	0	x	14	3.5
6	0	x	x	6	1.5
7	0	x	0	10	2.5
8	0	0	x	4	1.0
Total.................................				400	100.00

x Indicates the day or days on which one or more emesis occurred.

3. The influence of morphine administered hypodermatically after operation is, with respect to emesis, practically nil.

4. The dominating factor in the causation of emesis when the peritoneum of the intestines is not traumatized is ether and the limit of its influence is 24 hours.

*If it be held that these three cases should be considered in arriving at a conclusion regarding the influence of ether in producing emesis, then it would be necessary to extend the limit of ether emesis to 39 hours; but all things considered, it would seem justifiable to classify these cases as exceptions to the rule, i.e., that ether emesis does not exceed 24 hours.

A COMPARATIVE STUDY OF THE 400 LAPAROTOMIZED CASES (GROUP 2)
IN WHICH RUBBER ENVELOP PADS WERE USED AND THE 366 LAP-
AROTOMIZED CASES (GROUP 3) IN WHICH GAUZE WAS USED

EMESIS DURING FIRST THREE DAYS

An analysis of laparotomized cases in which rubber envelop pads
were used, group 2, shows the following:

Of the 400 cases constituting group 2, 108 cases, or 27 per cent, did
not vomit during the first 3 days of convalescence; 179 cases, or
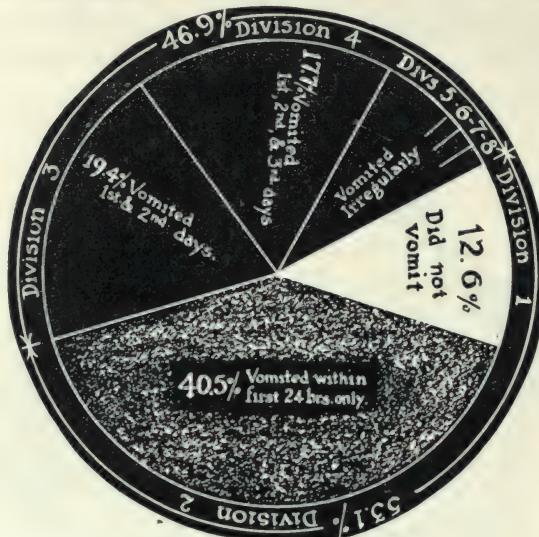
Fig. 3.—Group 3.   Cases in which gauze pads were used.

TABLE VI

GROUP 3.   LAPAROTOMIZED CASES WITH GAUZE; 366 CASES

| | EMESIS RECORD DAYS OF CONVALESCENCE | | | NO. OF CASES | PERCENTAGE IN |
DIVISIONS	1ST	2ND	3RD	IN EACH DIVISION	EACH DIVISION
1	0	0	0	46	12.6
2	x	0	0	148	40.5
3	x	x	0	71	19.4
4	x	x	x	65	17.7
5	x	0	x	19	5.2
6	0	x	x	5	1.4
7	0	x	0	6	1.6
8	0	0	x	6	1.6
Total.............................366					100.0

x Indicates the day or days on which one or more emesis occurred.

44.7 per cent, vomited during the first day only; 50 cases, or 12.5 per
cent, vomited during the first and second days only; 29 cases, or 7.3
per cent, vomited on each of the 3 days; 14 cases, or 3.5 per cent,

vomited on the second and third days only; 10 cases, or 2.5 per cent,
vomited on the second day only; and 4 cases, or 1 per cent, vomited
on the third day only.

An analysis of laparotomized cases in which gauze was used, group
3, shows the following:

Of the 366 cases of group 3, 46 cases, or 12.6 per cent, did not
vomit during the first 3 days of convalescence; 148 cases, or 40.5 per
cent, vomited during the first day only; 71 cases, or 19.4 per cent,
vomited during the first 2 days only; 65 cases, or 17.7 per cent,
vomited on each of the 3 days; 19 cases, or 5.2 per cent, vomited
on the first and third days only; 5 cases, or 1.4 per cent, vomited on
the second and third days only; 6 cases, or 1.6 per cent, vomited on

Fig. 4.—Group 2. Four hundred cases of which 386 cases, or 96.5 per cent, did not distend;
14, or 3.5 per cent, did distend.

the second day only and 6 cases, or 1.6 per cent, vomited on the third
day only.

INTESTINAL DISTENTION

A comparative study of the two groups shows that in group 2, some
form of distention occurred in 16 cases. Of these, 4 were recorded as
"distended" and 12 as "slightly distended." As 2 were recorded
as "gastric distention" the number of cases of intestinal distention
in this group was 14, or 3.5 per cent. Three cases distended on 2
successive days, no case distended on three successive days.

In group 3, there were 47 cases recorded as having had some form
of distention; 33 of these were recorded as "distended" or "con-
siderably distended" and 14 as "slightly distended." No cases were

recorded with "gastric distention." Therefore, the number of cases
with intestinal distention in this group was 47, or 13 per cent. Seven
cases distended on 2 successive days and 1 case distended on 3 suc-
cessive days.

It may be of interest to note the difference of distention occurring
in the corresponding divisions of the two groups as shown in table.

<div align="center">

TABLE VII

DIFFERENCE OF DISTENTION

</div>

GROUP 2		GROUP 3	
DIVISION	PERCENTAGE	DIVISION	PERCENTAGE
1	3.6	1	8.7
2	2.8	2	8.7
3	8.0	3	15.5
4	10.3	4	20.1
5	0	5	5.0
6	0	6	40.0
7	0	7	33.0
8	0	8	16.0

Our interest centers in the comparative difference in the 4 first
divisions of the 2 groups, as the last 4 divisions constitute only 8 or
9 per cent of their respective groups, and are too small to influence
materially conclusions drawn from the first 4 divisions; but as a
matter of information, it might be noted that in the 4 last divisions
of group 2, no distention occurred as contrasted with 16.6 per cent
in the corresponding divisions of group 3.

It will be noted that there is a marked increase in percentage be-
tween divisions 2 and 3, and 3 and 4 of each group and an equally
striking contrast of difference in divisions 3 and 4 of group 2 and
the corresponding divisions of group 3. The increase in percentage
between the second divisions of each group corresponds with the
increase in the duration of emesis in each respective division, namely
two successive days of emesis in division 3 and 3 successive days of
emesis in division 4. Also the difference in percentage in the same
divisions of the two groups is equally striking and shows that some
influence, causative of both emesis and distention, occurred to a
greater degree in one group than in the other.

Our previous analysis of group 1 showed that such a difference
could not be attributed to the length of time ether was administered,
to the amount of morphine, or to the character of operation. To what
then can such a difference be due?

The only factor common to both groups 2 and 3 and not found in
group 1, which might be considered as causative of both emesis and
distention, is peritoneal trauma; but in division 3 of group 2, we find
distention in 8 per cent of cases as compared to 15.5 per cent in the
corresponding division in group 3, and 12.5 per cent emesis in the

division 3 of group 2 as compared to 19.4 per cent in the corresponding division of group 3. In division 4 of group 2, we find distention in 10.3 per cent of cases as compared to 20.1 per cent in the corresponding division of group 3 and 7.3 per cent emesis in division 4 of group 2, as compared to 17.7 per cent in the corresponding division of group 3.

This analysis shows that the common causative factor, which prolonged the time or duration of emesis and increased the percentage of distention, influenced both groups, but this is true to a lesser degree in one group than in the other, leading us to the conclusion that, as in divisions 3 and 4 in group 2, we have a markedly lessened percentage in both emesis and distention than in group 3; and as in

Fig. 5.—Group 3. Three hundred sixty-six cases of which 319, or 87 per cent, did not distend, and 47, or 13 per cent, did distend.

group 2, the procedure adopted to keep the intestines out of the pelvis was less traumatizing than that used in group 3, a lesser degree of intestinal peritoneal trauma occurred, resulting in less emesis and distention in group 2 than in group 3.

MORPHINE

A comparative study with respect to morphine shows that in group 2 there were 17 patients who received no morphine during the first, second, and third days of convalescence. These were classified with respect to operations as shown in Table VIII.

In group 3, there were 9 patients who received no morphine during the first 3 days of convalescence. These were classified with respect to operations as follows in Table IX.

It will be seen that practically 50 per cent more of cases received no morphine on the first 3 days of convalescence in group 2 than in group 3.

The total amount of morphine used in group 2 was 330 grains, or an average of 0.82 grain during the first 3 days of convalescence.

The total amount of morphine used in group 3 was 347 grains or an average of 0.95 grain during the first 3 days of convalescence.

TABLE VIII

No Morphine Given in First Three Days; Group 2

Retroversion	5
Supravaginal hysterectomy	5
Adnexal operations	3
Myomectomy	1
Exploratory	1
Separation of adhesions	1
Resection of ileum	1
Total	17, or 4.2 per cent

These analyses show that in group 2 not only did a much greater number of individual cases pass through the first 3 days of convalescence without receiving morphine than in group 3, but that each day there were many more cases in group 2 than in group 3 which received no morphine, also that the total number of grains used in the 400 cases of group 2 were considerably less, i.e., 17, than the total number of grains used in the 366 cases of group 3.

TABLE IX

No Morphine Given in First Three Days; Group 3

Retroversions	2
Supravaginal hysterectomy	2
Appendix	1
Exploratory	2
Myomectomy	2
Total	9, or 2.4 per cent

In the first 4 divisions of each group, the average amount of morphine administered was greater in division 4 than in the other divisions. The question may arise as to whether the extended duration of emesis in this division (namely emesis on each of the 3 days) was the result of a larger average amount of morphine administered in this division than was administered in the other divisions. But it will be remembered that it was established by the analysis of group 1 that morphine *per se* (postoperative) does not occasion emesis.

It is, therefore, evident that the increased amount of morphine administered was due to an increase in amount and extent of pain. This increase in the amount of pain in the laparotomized groups was

TABLE X

COMPARISON OF RESULTS WHERE MORPHINE IS USED AND WHERE IT IS NOT

AMOUNT OF MORPHINE ADMINISTERED ON THE INDIVIDUAL DAYS

	Group 2		
1st day	168 grs.	average	.42 gr.
2nd day	118 grs.	average	.29 gr.
3rd day	44 grs.	average	.11 gr.
	Group 3		
1st day	190 grs.	average	.52 gr.
2nd day	109 grs.	average	.30 gr.
3rd day	48 grs.	average	.13 gr.

CASES RECEIVING NO MORPHINE ON THE INDIVIDUAL DAYS

	Group 2		
1st day	28 cases	or	7 per cent
2nd day	96 cases	or	24 per cent
3rd day	257 cases	or	64 per cent
	Group 3		
1st day	11 cases	or	3 per cent
2nd day	64 cases	or	17 per cent
3rd day	176 cases	or	47 per cent

the result of an element not found in the nonlaparotomized, i.e., peritoneal trauma; and it is presumably this element that not only increased the amount of pain, but extended the duration of emesis.

THE INFLUENCE OF RECTAL THERAPY ON POSTOPERATIVE EMESIS; ITS COMPARATIVE USE IN GROUPS 2 AND 3

SALINE, BICARBONATE OF SODA, GLUCOSE SOLUTIONS, AND HOT WATER ADMINISTERED PER RECTUM IMMEDIATELY BEFORE THE TERMINATION OF OPERATION

When saline, bicarbonate of soda, glucose, or hot water is administered *per rectum* immediately before the termination of an abdominal section, what influence, if any, have they in lessening or preventing postoperative emesis?

In group 2 no rectal therapy was used immediately before the termination of operation.

In group 3 there were 212 cases, or 58 per cent, in which some form of rectal therapy was used immediately before the completion of operation.

The solutions were administered as follows:

Saline solution	49
Bicarbonate of soda	103
Glucose, 5 per cent solution	8
Hot water	52

When the comparative records of groups 2 and 3, with respect to emesis, are recalled, the above analysis brings into serious question the efficacy of rectal therapy, if it does not conclusively prove that the effect of such therapy with regard to preventing or modifying postoperative emesis is nil.

SALINE, BICARBONATE OF SODA, AND GLUCOSE SOLUTION ADMINISTERED PER
RECTUM IN THE FORM OF "DRIPS" AFTER OPERATION
(MURPHY AND HARRIS)

The same question may be asked regarding the influence of these
solutions upon postoperative emesis in the form of "drips" as was
asked regarding the administration of these solutions in quantity *per
rectum* immediately before the termination of the operation.

In group 2, we find that the Murphy drip was used in 2 cases and
the Harris drip in 5 cases: total 7 cases, or 1.7 per cent; in 1 of these
7 cases the "drip" was used 2 days successively, or 0.2 per cent.

In group 3, we find that the Murphy drip was used in 68 cases and
the Harris drip in 13 cases: total 81 cases, or 22.1 per cent; in 23 of
these cases the "drip" was used 2 days successively and in 9 cases
3 days successively, or a total of 8.7 per cent of cases in which the
"drip" was used in successive days.

This analysis would lead us to practically the same conclusion as
previously reached regarding the relationship of emesis to rectal
therapy when used at the termination of operation; but whatever in-
fluence postoperative rectal therapy in the form of "drips" may exert
in preventing emesis, it is entirely the result of its action in stimulat-
ing peristalsis, thereby lessening intestinal distention, to which emesis
at times is due.

TIME OF ETHERIZATION AND ITS RELATION TO POSTOPERATIVE EMESIS

A study of the laparotomized groups 2 and 3 with respect to the
relationship between time of etherization and postoperative emesis
cannot be made with the same satisfaction as the nonlaparotomized
group (group 1), because of the introduction in the laparotomized
groups of the element of peritoneal trauma.

However, a study of the first four divisions of groups 2 and 3 (divi-
sions which constitute collectively 91.5 per cent and 90.2 per cent of
their respective groups) corroborate the finding in the study of group
1 with respect to the relationship between the time of etherization
and the duration of postoperative emesis—namely that the element
of time *per se,* has little or no influence as a factor in extending the
duration of postoperative emesis.

It is self-evident that the influence of time in division 1 of groups 2
and 3 could have had no possible bearing upon the question of emesis
in this division, as no emesis occurred in this divison of either group.

In comparing division 2 of groups 2 and 3, we find that there is a
difference of only 1.1 per cent of cases which were etherized two or
more hours and a difference of only 1 per cent of cases which were
etherized less than 2 hours.

The difference in percentage is here so little and the difference in

percentage with respect to emesis is so small, namely 4 per cent, that this division may be left out of consideration in our analysis.

In division 3 of group 2, we find that there was 36.9 per cent of cases which were anesthetized 2 hours or more as compared to 18.3 per cent in the corresponding division of group 3; and in division 4 of group 2, we find that there was 41.3 per cent of cases which were anesthetized 2 hours or more as compared to 24.6 per cent in the corresponding division of group 3.

TABLE XI

TIME OF ETHERIZATION IN FIRST FOUR DIVISIONS OF GROUPS 2 AND 3

DIVISION I

Group 2—108 Cases
Two hours and over...............23.9 per cent of cases
Less than 2 hours............76.1 per cent of cases

Group 3—46 Cases
Two hours and over...............28.0 per cent of cases
Less than 2 hours.................72.0 per cent cases

DIVISION 2

Group 2—179 Cases
Two hours and over...............28.7 per cent of cases
Less than 2 hours.................71.3 per cent of cases

Group 3—148 Cases
Two hours and over............27.7 per cent of cases
Less than 2 hours.................72.3 per cent of cases

DIVISION 3

Group 2—50 Cases
Two hours and over...............36.9 per cent of cases
Less than 2 hours.................63.1 per cent of cases

Group 3—71 Cases
Two hours and over............18.3 per cent of cases
Less than 2 hours.................71.7 per cent of cases

DIVISION 4

Group 2—29 Cases
Two hours and over...............41.3 per cent of cases
Less than 2 hours..............58.7 per cent of cases

Group 3—65 Cases
Two hours and over...............24.6 per cent of cases
Less than 2 hours..............75.6 per cent of cases

Here it will be seen that though the percentage of cases, which were under ether 2 hours or more in divisions 3 and 4 of group 3, was smaller than in the corresponding division of group 2, yet the percentage of postoperative vomiting respecting days in these divisions of this group was larger than in the corresponding divisions of group 2, i.e., 12.5 per cent as compared to 19.4 per cent and 7.3 per cent as compared to 17.7 per cent.

In division 3 of group 2 we find that there was 63.1 per cent of cases which were anesthetized between 1 and 2 hours as compared to 81.7 per cent in the corresponding division of group 3; and in division

4 of group 2 we find that there was 58.7 per cent of cases which were anesthetized between 1 and 2 hours as compared to 75.6 per cent in the corresponding division of group 3.

Here it will be seen that though the percentage of cases which were under ether between 1 and 2 hours of divisions 3 and 4 of group 3 was larger than in the corresponding divisions of group 2, yet the percentage of vomiting respecting days in these divisions of group 3 was greater than in the corresponding divisions of group 2, as has just been noted.

TABLE XII

DIVISION I		DIVISION 3	
Group 2		Group 2	
Supravaginal hysterectomy	35	Supravaginal hysterectomy	13
Panhysterectomy	3	Panhysterectomy	9
Retroversion	26	Retroversion	16
Adnexal and appendiceal	38	Adnexal and appendiceal	19
Resection of intestines	3	Myomectomy	1
Exploratory	2	Umbilical hernia	1
Myomectomy	1		
			50
	108	Group 3	
Group 3		Supravaginal hysterectomy	11
Supravaginal hysterectomy	17	Panhysterectomy	9
Panhysterectomy	8·	Retroversion	25
Retroversion	16	Adnexal and appendiceal	20
Adnexal and appendiceal	3	Myomectomy	4
Myomectomy	2	Exploratory	2
	46		71
DIVISION 2		DIVISION 4	
Group 2		Group 2	
Supravaginal hysterectomy	51	Supravaginal hysterectomy	8
Panhysterectomy	10	Panhysterectomy	0
Retroversion	57	Retroversion	8
Adnexal and appendiceal	50	Adnexal and appendiceal	8
Exploratory	2	Myomectomy	5
Myomectomy	5		
Ventral hernia	4		29
	179	Group 3	
Group 3		Supravaginal hysterectomy	12
		Panhysterectomy	11
Supravaginal hysterectomy	46	Retroversion	22
Panhysterectomy	15	Adnexal and appendiceal	15
Retroversion	53	Myomectomy	4
Adnexal and appendiceal	26	Hernia	1
Exploratory	3		
Myomectomy	4		65
Ventral hernia	1		
	148		

That is in divisions 3 and 4 of group 2 there was a greater percentage of cases which were etherized 2 hours or more with a less percentage of postoperative vomiting respecting days than in the corresponding division of group 3; while in divisions 3 and 4 of group 3 there was a greater percentage of cases etherized less than 2 hours

TABLE XIII

COMPARATIVE STUDY OF OPERATIONS, ANESTHETISTS, ETC.

Operators

In group 2—rubber pad

No. 1 did 62 per cent of entire work

No. 2 did 32 per cent of entire work

No. 3 did 6 per cent of entire work

Anesthetists

Resident did 92.75 per cent of entire work

Special did 3.75 per cent of entire work

Not recorded, 3.5 per cent of entire work

Peritoneal adhesions

In 38.5 per cent

Abdominal and vaginal drainage

In 8.0 per cent

Incision

Longitudinal in 80 per cent

Transverse in 20 per cent

Union

Primary in 98 per cent

Secondary in 2 per cent

Age

45 years or over, 14.2 per cent

Under 45 years, 70.6 per cent

Not recorded, 15.2 per cent

Private and ward cases

Ward—73.5 per cent

Private—26.5 per cent

Glucose intravenously

None administered

Saline intravenously

None administered

In group 3—gauze pad

No. 1 did 70 per cent of entire work

No. 2 did 30 per cent of entire work

Resident did 78.7 per cent of entire work

Special did 20.76 per cent of entire work

Not recorded, 0.54 per cent of entire work

In 24.6 per cent

In 2 per cent

Longitudinal in 99.7 per cent

Transverse in 0.3 per cent

Primary in 97.5 per cent

Secondary in 2.5 per cent

45 years or over, 9.9 per cent

Under 45 years, 65.2 per cent

Not recorded, 24.9 per cent

Ward—80 per cent

Private—20 per cent

First day 300 c.cm. in 3 cases

Div. 2.

300 c.cm. in 1 case

Second day 500 c.cm. in 1 case

Div. 3

400 c.cm. in 1 case

First day, 750 c.cm. 1 case

c.cm. 1 case

100 c.cm. 1 case

---

with a greater percentage of postoperative emesis than in the corresponding divisions of group 2.

A STUDY OF THE CHARACTER OF OPERATION IN THE TWO GROUPS WITH RESPECT TO THEIR INFLUENCE UPON EMESIS

As it might be argued that the character of operation influences postoperative results with respect to emesis, it will be necessary to compare the character and number of operations in the different divisions of the two groups. As the first four divisions of groups 2 and 3 constitute 91.5 per cent and 90.2 per cent of their respective

groups, they are sufficient in number and percentage to determine the point in question.

A review of Table XII will convince one that all operations, except panhysterectomy, are in fair proportion, represented in the several divisions of the two groups. It is generally conceded that panhysterectomy is a grave operation and frequently followed by stormy convalescence, yet in divisions 1 and 2 of group 2 (divisions in which emesis when occurring did not exceed 24 hours) there is 4.5 per cent of panhysterectomies as compared to nothing in the divisions in which vomiting extended to the second or third days, namely divisions 3 and 4. In the same divisions in group 3 there was 11.7 per cent as compared to 14.6 per cent. This table furnishes sufficient evidence, it would seem to show, that neither the character nor the gravity of the operation influences necessarily postoperative results regarding emesis.

CONCLUSIONS REGARDING LAPAROTOMIZED CASES

1. In 400 successive laparotomized patients, the use of rubber envelop pads resulted in freedom from vomiting in practically the same proportion as in the nonlaparotomized patients.

2. Comparing nearly equal numbers of laparotomized cases under approximately the same conditions, this study demonstrates that to substitute the rubber envelop pads for gauze pads is to double the chance of escaping vomiting; to reduce 2 days vomiting by one-third; to cut 3 days vomiting 60 per cent; and to lessen distention by two-thirds.

3. The dominant factors in the causation of emesis in laparotomized cases are ether and trauma of the peritoneum of the intestines and while the influence of ether is only 24 hours, the influence of intestinal peritoneal trauma may extend to 3 days or more.

4. Less vomiting, less distention and less morphine show less trauma to the peritoneum.

DESCRIPTION OF DIAGRAMS OF COMPARATIVE PERCENTAGES OF EMESIS IN THE THREE GROUPS

In the diagrams (Figs. 1 to 5), division 1 of each group, the division in which no vomiting occurred, is designated by white. Division 2 of each group, the division in which vomiting occurred on the first day only, is designated in gray; and the remaining 6 divisions are designated by black.

Comparing the divisions of group 2 (the group in which rubber envelop pads were used) with the divisions of group 1 (the nonlaparotomized group) and with group 3 (in which gauze was used), we find that 27 per cent of group 2 (division 1) did not vomit as com-

pared to 26.7 per cent of group 1 (division 1) and 12.6 per cent of group 3 (division 1); therefore the number of laparotomized cases which did not vomit when rubber envelop pads were used was practically the same as did not vomit in the nonlaparotomized work, but more than twice as many did not vomit in the laparotomized group in which gauze was used.

We find that 44.7 per cent of group 2 (division 2) vomited on the first day only as compared to 69.3 per cent of group 1 (division 2) and 40.5 per cent of group 3 (division 2); therefore the number of cases of group 2 which vomited on the first day only is about one-third less than those of group 1, and a little more than those of group 3.

The most striking contrast in the 6 remaining divisions of the laparotomized groups (group 2 and 3) is in division 3 in which vomiting occurred on the first and second days only, and division 4 in which vomiting occurred on the first, second and third days. Here we find that when rubber envelop pads were used, 12.5 per cent vomited on the first and second days only as compared to 19.4 per cent when gauze was used; and that only 7.3 per cent vomited on the first, second and third days when the rubber envelop pads were used as compared to 17.7 per cent when gauze pads were used.

When the first 2 divisions of the three groups are considered collectively and contrasted with the remaining 6 divisions of their respective groups we find that—

First, the divisions 1 and 2 of group 1, divisions in which vomiting either did not occur or occurred only during the first day, constitute 96 per cent of the entire group as contrasted with 4 per cent of the remaining 6 divisions in which vomiting occurred on and after the first day or only after the first day.

Second, divisions 1 and 2 of group 2, divisions in which vomiting either did not occur or occurred only during the first day, constitute 71.7 per cent of the entire group as contrasted with 28.3 per cent of the remaining 6 divisions in which vomiting occurred on and after the first day or only after the first day.

Third, divisions 1 and 2 of group 3, divisions in which vomiting did not occur or occurred only during the first day, constitute 53.1 per cent of the entire group as contrasted to 46.9 per cent of the remaining 6 divisions in which vomiting occurred on and after the first day or after the first day only.

Finally, group 1 determines the normal limitations of postoperative emesis with respect to time and is the standard for reference. In contrasting the other groups with group 1, it will be seen that group 2 approximates more nearly the standard than does group 3.

DESCRIPTION OF RUBBER ENVELOP PADS

The rubber envelop pads consist of two parts, an envelop and a pad. The envelop is made of thin rubber tissue and the pad is made of toweling material sewed together in such a manner as to give firmness and resistance. A loop of narrow tape ten inches or more in length is sewed to the upper border of the cloth pad. When the cloth pad is placed in the envelop the loop of tape is passed through reenforced holes located on the upper margins of the rubber envelop. By this means the envelop is closed and the pad prevented from escaping. An iron ring is attached to the free end of the loop of tape for the purpose of indicating the presence of a pad in the cavity. Three pads, two large and one small, constitute a set; the larger are eight by eight inches and the smaller eight by four inches.
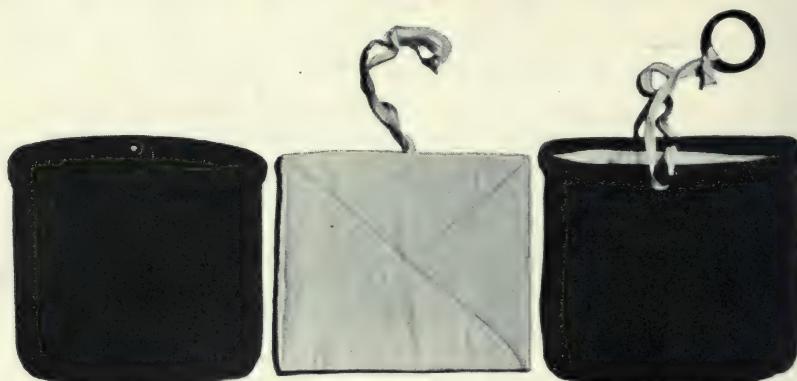
Fig. 6.—Photograph showing rubber envelop, towel pad, and pad complete.

The rubber envelop pads are used intraabdominally in the place of gauze pads. Whether the patient is placed in the Trendelenburg position or not, the intestines should be pushed above the iliopectineal line before introducing the pads; the abdominal wall is then lifted with a retractor and one of the large pads folded lengthwise is placed in the region of the cecum, the other is placed in the region of the sigmoid, and the smaller pad is placed perpendicularly in the middle of the true pelvis. The small pad is again used when the peritoneal layer of the wound is being sutured to keep the intestines from the field of work. It can be removed through a very small opening without traumatizing the peritoneum in the region of the wound.

Gauze pads should never be used in the envelopes as substitutes for towel pads as they do not furnish the required firmness and resistance to keep the intestines away from the field of operation.

END RESULTS OF AMPUTATION OF THE CERVIX AND TRACHELORRHAPHY*

By Reginald M. Rawls, M.D., F.A.C.S.

Attending Surgeon

IT IS a far cry from the crude amputation of the cervix, with the ecraseur, to the finished surgical procedure devised by Sims and perfected by Emmet and the conservative trachelorrhaphy of Emmet. The technic of these masters has survived for a little over a half century and during this time there has arisen a considerable literature *pro* and *con*. Some writers refer to trachelorrhaphy as "uterine tinkering" and others hold that subsequent to amputation there is a high percentage of sterility and if by chance pregnancy occurs it is likely to end in abortion or premature labor or if it should go to term there will be more or less dystocia. A few even contend that, after amputation of the cervix, elective cesarean section is indicated in subsequent pregnancies. Such sequelae are unquestionable if cervix operations are performed without proper technic or indications.

Almost fifty-nine years ago Emmet[1] performed his first trachelorrhaphy, as he believed amputation of the cervix unnecessary except for removal of a cauliflower growth, malignant disease or excessive hypertrophy sometimes several inches in length. But after thirty-five years' experience with the operation, he states "for many years I held the opinion that it was possible, in almost every instance, by careful local and general treatment to restore in time the lacerated tissues to so near the normal condition that, when the operation (trachelorrhaphy) had been properly performed complete restoration would eventually take place with the result of bringing about involution of the uterus. But I am now of the opinion that there are exceptions to this rule, when it is better surgery to amputate a portion or the whole of the cervix provided the diseased tissues are completely removed and the wound treated in the manner I shall describe." This quotation gives us the indication for cervical repair of a quarter of a century ago as recognized by the originator of trachelorrhaphy and the man most capable of carrying out the technic.

Hirst,[2] Crossen,[3] Eden and Lockyer,[4] Anspach,[5] and Graves,[6] all agree on the indications for trachelorrhaphy but Anspach limits amputation to women past the childbearing period and Graves to pro-

cidentia. Others, including Sturmdorf,[7] question the efficacy of either procedure.

The most recent statistics of the postoperative results of amputation of the cervix and trachelorrhaphy are those of Leonard[8] which are based on replies to circular letters received from 128 of 400 cases of amputation of the cervix, performed during the preceding twenty years, and from 39 of the cases of trachelorrhaphy, performed during the preceding ten years, in the Gynecological Clinic of the Johns Hopkins Hospital. The method of operation in this series of cases was either "almost without exception, a high amputation . . . from 2.5 to 3 cm. of the cervix above the external os being removed" or the classical trachelorrhaphy of Emmet. The indications governing the selection of the method of operation were almost invariably to amputate a cervix badly infected or one showing multiple lacerations and to use trachelorrhaphy in those cases presenting one or two more or less discrete lacerations and without a marked endocervicitis. Sturmdorf,. after giving a summary of Leonard's conclusions says, "accepting these data from authoritative sources, as a correct exposition of facts, the obvious deduction is, that with chronic endocervicitis as the recognized pathologic indicator, trachelorrhaphy is an inadequate, and cervix amputation an injurious, operation."

To me it seems unfair to condemn the old and tried methods of cervical repair of Sims and Emmet and to recognize the newer and less tried tracheloplasty methods as a specific in all cervical disease. Especially is this true if we accept the statistics of Leonard for high amputation and apply them to all degrees of amputation. Thus the time seems ripe to study another series of cases of cervical operations and to compare the postoperative results of amputation of the cervix and trachelorrhaphy.

At the Woman's Hospital from January 1, 1916, to January 1, 1919, there were admitted approximately 6503 gynecological patients and alone or combined with other operative procedures 11 per cent had cervical operations. Amputation of the cervix was performed 461 times and trachelorrhaphy was performed 232 times. Two-thirds of the amputations and seven-eighths of the trachelorrhaphies were done on women under forty years of age, and were about equally combined with vaginal plastic and abdominal operations. This series is composed of 305 private cases and 394 ward cases performed by 41 individual operators. Two hundred eleven, or approximately 30 per cent, have been followed from one to five years. The technic of, and indications for, operation were those of Emmet more or less faithfully carried out, namely, to excise the diseased cervical tissue by a low, median or high amputation or to perform the classical trachelorrhaphy.

PLAN OF STUDY

To classify the cases and to find the immediate results the individual hospital records of the 693 cases were carefully gone over. The remote or end results were obtained, from the ward cases, by writing to each patient to report to her fellow-up clinic and when she did not report, a questionnaire was sent requesting that it be filled out and returned to the Record Department of the hospital. For the private cases, questionnaires were sent to their surgeons who were asked to return their end results with the privilege of using them in this report. In this manner 67 ward cases were re-examined by ten examiners and 75 returned complete questionnaires two and one-half to five years after operation. Among the private cases, 69 were re-examined by 17 operators from one to five years after operation. Combining these returns we have 136 cases re-examined from one to five years and our end results based on letters in only 75 ward cases. Included in these 211 cases, there were 132 amputations of the cervix and 79 trachelorrhaphies. Amputation was done in 81 patients under forty years of age and in 51 patients over forty years of age. Trachelorrhaphy was done in 74 under and in 5 over forty years of age. Seventy-three amputations and 33 trachelorrhaphies were done alone or were combined with other vaginal plastic operations. 56 amputations and 45 trachelorrhaphies had in addition some form of conservative abdominal operation, and three amputations and one trachelorrhaphy accompanied a bilateral salpingectomy. Approximately 64 per cent of the cases were re-examined one to five years subsequent to operation. The personal equation of the author has been eliminated as he is merely the tabulator, in the great majority of the cases, of the findings recorded by a number of examiners. Further, but 35.5 per cent of our end results are dependent upon answers to circular letters, as compared to 100 per cent in Leonard's series.

PATHOLOGY OF CERVICAL TISSUE REMOVED

About 67 per cent of the specimens of cervical tissue removed at operation was subjected to a microscopic examination including about 92 per cent removed by amputation and about 18 per cent removed by trachelorrhaphy. Approximately 76 per cent of the tissue specimens examined, showed cervical changes other than simple lacerations. This was present in cases of amputation in about 76 per cent and in cases of trachelorrhaphy in about 71 per cent. These changes, in their order of frequency were erosion, cervicitis, hyperplasia, endocervicitis, circulatory disturbance, precancerous changes, and carcinoma. It is most interesting to note that in 466 cases in which the tissue was examined microscopically, there was but one case each of precancerous change and carcinoma.

I. IMMEDIATE RESULTS

1. *Secondary Hemorrhage.*—There were 8 cases of secondary hemorrhage, or 1.2 per cent in our series. In none of these cases was it necessary to resort to resuturing and in but one case was it necessary to use a vaginal pack, and in all but three of these cases there was subsequent primary union. Hemorrhage occurred on the second day in 2 cases, the sixth day in 1 case, the ninth day in 2 cases, and the twelfth day in 3 cases. Thus less than ½ per cent of the amputations (2 of 461) and about 2.5 per cent of the trachelorrhaphies (7 of 232) were complicated by secondary hemorrhage. The percentage of hemorrhage, but not the degree conforms with the earlier reported cases following trachelorrhaphy of Goodell and Emmet[9] rather than the more recent cases reported by Leonard. The latter in his study found six of 128 amputations severe enough to require resuture, or 4.7 per cent, and two of 39 cases of trachelorrhaphy which were controlled by vaginal pack, or 5.1 per cent. The low percentage for amputation in our series as compared to Leonard's, is possibly due to two factors. First, high amputation was the exception rather than the rule and, second, a vaginal pack was usually placed following all cervical operations. An interesting fact in this connection is that but three of these cases, all trachelorrhaphies, were followed by secondary or partial union which would seem to indicate that the hemorrhage was due to faulty hemostasis or errors of technic in tying the sutures which caused necrosis of the tissues rather than a sepsis from existing endocervicitis.

2. *Secondary Union or Partial Primary Union.*—In addition to the three cases of secondary or partial primary union, there were five cases of secondary or partial union or a fraction over 1 per cent (8 of 693). Four occurred after trachelorrhaphy and four after amputation, about 2 and 1 per cent, respectively. Three of the four cases of secondary or partial union in trachelorrhaphy were subsequent to secondary hemorrhage, and one of the four amputations in which secondary or partial union resulted was a case in which an extensive vaginal section was also done. In none of the cases was there a serious sepsis which in any way contributed to the mortality in this series of cases.

II. REMOTE OR END RESULTS

1. *General Health.*—The influence of cervical operations on the general health is a complex question and one that must be almost entirely analyzed from a subjective basis. This is necessarily the case as primarily the patient must be relieved of the symptoms for which she sought operation. A review of the following table shows that trachelorrhaphy alone gives a little over 16 per cent greater improvement in the general health than amputation alone. On the other hand,

amputation when combined with vaginal plastic operations gives almost 21 per cent greater improvement in the general health than trachelorrhaphy combined with vaginal plastic operations. When combined with abdominal operations, the difference for the two methods is negligible as they both show improvement in over 86 per cent. The discrepancy in the end results of amputation and trachelorrhaphy alone when contrasted with the results when they are combined with vaginal plastic measures seems to be explained on the theory that in the cases requiring amputation the primary injury also caused lesions in the vagina which should have been repaired to relieve the symptoms and thus improve the general health. Thus our statistics indicate that both methods improve the general health but the greater improvement results from amputation when combined with plastic repair.

TABLE I

INFLUENCE OF AMPUTATION AND TRACHELORRHAPHY ON THE GENERAL HEALTH

OPERATION	NUMBER OF CASES	NUMBER OF CASES IMPROVED
Amputation	12	8 (66.6%)
Trachelorrhaphy	12	10 (83.3%)
Amputation and vaginal plastic operations	48	42 (87.5%)
Trachelorrhaphy and vaginal plastic operations	21	14 (66.6%)
Amputation and abdominal operations	53	47 (86.8%)
Trachelorrhaphy and abdominal operations	48	43 (89.6%)
Totals—		
Amputation	113	97 (85.8%)
Trachelorrhaphy	81	67 (82.7%)
	194	164 (84.5%)

2. *Leucorrhea.*—The most frequent cause of persistent vaginal discharge is cervical disease and in the multiparous woman the predisposing cause is cervical laceration. On this basis it is interesting to determine, in our series of cases, the occurrence of leucorrhea before operation and its degree or cure after operation (see Chart 1).

In 194 cases of cervical operations a leucorrhea more or less constant and of varying degrees occurred in 70.1 per cent, before amputation in 65.6 per cent and before trachelorrhaphy in 78.8 per cent. To determine accurately the end results for leucorrhea requires examinations made from time to time but unfortunately, in most of our cases, the end results are based on one examination made from one to five years after operation. The discharge present may be due to a reinfection of a cervix restored to the normal by operation or the discharge may have eventually disappeared notwithstanding. This applies equally to both methods of operating; it seems reasonable to

CHART · 2.

·A· EFFECT of OPERATION ON DYSMENORRHOEA
Whole series

Amputation (105 cases)   Trachelorrhaphy (64 cases)

WORSE 11·4   WORSE 11·6

ENTIRELY RELIEVED 54·5   ENTIRELY RELIEVED 34·6

UN-CHANGED 15·9   UN-CHANGED 26·9

PARTIALLY RELIEVED 18·2   PARTIALLY RELIEVED 26·9
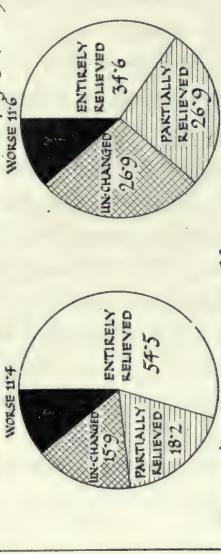
Dysmenorrhoea only after operation 66
Occurrence of Dysmenorrhoea before operation
Amputation 47·2
Trachelorrhaphy 70·6

·B· CERVICAL OPERATIONS ONLY or with VAGINAL PLASTIC
OPERATIONS

Amputation (62 cases)   Trachelorrhaphy (54 cases)

WORSE 9·1   WORSE 8·3

ENTIRELY RELIEVED 40·9   ENTIRELY RELIEVED 33·3

UN-CHANGED 27·3   UN-CHANGED 16·7

PARTIALLY RELIEVED 22·7   PARTIALLY RELIEVED 41·7
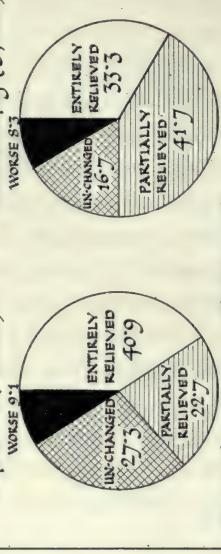
Dysmenorrhoea only after operation in (2 cases) 5·0
Occurrence of Dysmenorrhoea before operation
Amputation 35·5
Trachelorrhaphy 35·3

CHART · 1.

·A· EFFECT of OPERATIONS ON LEUCORRHEA
Whole Series 194 cases.

Amputation (128 cases)   Trachelorrhaphy (66 cases)

WORSE 1·1   WORSE 3·8

ENTIRELY RELIEVED 60·7   ENTIRELY RELIEVED 44·2

UN-CHANGED 7·1   UN-CHANGED 13·5

PARTIALLY RELIEVED 31·1   PARTIALLY RELIEVED 38·5

Leucorrhoea only after operation 97% Leucorrhoea only after operation 7·1%
Occurrence of Leucorrhoea before operation
Amputation 65·6
Trachelorrhaphy 78·8

·B· CERVICAL OPERATIONS ONLY or with VAGINAL PLASTIC
OPERATIONS

Amputation (77 cases)   Trachelorrhaphy (35 cases)

WORSE 69   WORSE 9·1

ENTIRELY RELIEVED 56·9   ENTIRELY RELIEVED 34·5

UN-CHANGED 9·8   UN-CHANGED 20·7

PARTIALLY RELIEVED 33·3   PARTIALLY RELIEVED 37·9

Leucorrhoea only after operation 15·4% Leucorrhoea only after operation 0%
Occurrence of Leucorrhoea before operation
Amputation 66·2
Trachelorrhaphy 82·9

assume that any difference in the end results would be due to the form of operation.

Subsequent to amputation the leucorrhea was entirely relieved in 60.7 per cent and partially relieved in 31.1 per cent as compared to trachelorrhaphies with subsequent entire relief in 44.2 per cent and partial relief in 38.5 per cent. As to the character of the existing

leucorrhea after amputation it was unchanged in 7.1 per cent and worse in 1.1 per cent and for trachelorrhaphy it was unchanged in 13.5 per cent and worse in 3.8 per cent. In cases without leucorrhea before operation, it was present in 4 of 44 cases, or 9.1 per cent, for amputation and in 1 of 14 cases, or 7.1 per cent, for trachelorrhaphy.

If we exclude cervical operations combined with abdominal section which show an almost equal percentage of improvement for each method of operating (94.0 compared to 95.6), there will remain cervical operations alone or combined with vaginal plastic operations. From this series, cervical operation being the principal cause of the change in the vaginal discharge, we obtain definite end results. Therefore for amputation with existing leucorrhea in 66.2 per cent and for trachelorrhaphy with existing leucorrhea in 82.9 per cent, there was for amputation, contrasted with trachelorrhaphy, 22.4 per cent more complete relief (56.9 compared to 34.5) but 4.6 per cent less partial relief (33.3 compared to 37.9) and 10.9 per cent fewer cases in which the leucorrhea was unchanged in character. On the other hand, following amputation no cases were made worse whereas following trachelorrhaphy 2 of 35 cases, or 6.9 per cent, were worse. But 4 of 26 cases, or 15.4 per cent, of the cases subjected to amputation who were free of leucorrhea now had a mild degree of vaginal discharge.

Finally, amputation of the cervix is more efficient than trachelorrhaphy in the cure of leucorrhea, but more often than trachelorrhaphy causes a leucorrhea in cases previously free from a vaginal discharge. Such end results are not surprising even if we accept the theory that endocervicitis is the principal cause of leucorrhea. For it is unreasonable to assume that in every case of leucorrhea all the cervical glands, from the external to the internal os, are diseased. Therefore, as demonstrated by our series of cases, there is a place even in the treatment of leucorrhea for low, medium and high amputation and to a lesser degree for trachelorrhaphy. The end results further demonstrate the necessity for careful study of the indications and the performance of proper technic or too small an external os will result or some of the diseased glands will be left and the vaginal discharge will be worse in character or it will occur in cases free of leucorrhea before operation.

3. *Dysmenorrhea.*—In the nullipara, malformation or disease of the cervix is recognized as a causative factor of dysmenorrhea, but in the multipara laceration and its accompanying disease has received but scant attention as a cause of dysmenorrhea. However a review of Chart 2 of cervical operations shows an existing dysmenorrhea in 41.4 per cent; for amputation in 41.9 per cent and for trachelorrhaphy in 40.6 per cent.

Subsequent to amputation there is entire relief of dysmenorrhea in

54.5 per cent and partial relief in 18.2 per cent as compared to trach-elorrhaphy with entire relief of the dysmenorrhea in 34.6 per cent and partial relief in 26.9 per cent. The degree of remaining dysmenor-rhea was, for amputation, unchanged in 15.9 per cent and worse in 11.4 per cent as compared to trachelorrhaphy with the pain unchanged in 26.9 per cent and worse in 11.6 per cent. However, in cases free from monthly pain before operation it was subsequently present only after amputation in 6.6 per cent.

If we deduct the cervical operations combined with abdominal section, which give for amputation 31.8 per cent more entire and partial relief of the dysmenorrhea than trachelorrhaphy there re-main cervical operations alone or combined with vaginal plastic operations. Thus for amputation contrasted with trachelorrhaphy with about an equal percentage of existing dysmenorrhea (35.5 com-pared to 35.3) there was for amputation 7.6 per cent more entire relief from the dysmenorrhea (40.9 compared to 33.3) but there was 19.0 per cent less partial relief (22.7 compared to 41.7). Therefore while trachel-orrhaphy gives more cases with an improvement of the dysmenorrhea yet amputations give more cures of this symptom. Of the unimproved cases amputation contrasted with trachelorrhaphy gives 10.6 per cent more cases with the dysmenorrhea unchanged in character (27.3 com-pared to 16.7) but for each operation there is about the same percent-age of the cases (9.1 compared to 8.3) in which the character of the pain was worse after operation. However, only after amputation in 40 cases free from dysmenorrhea before operation it was now very severe in 2 or 5 per cent.

Finally amputation, as compared with trachelorrhaphy, is more efficient in the cure of dysmenorrhea but both operations cause the existing pain to be more severe in character in from 8 to 11 per cent of the cases and amputation alone causes subsequent dysmenorrhea in from 5 to 6 per cent of the cases previously free from menstrual pain. Thus there is the necessity for careful study of the individual case and the application of the proper operation and technic for each case or the external os may be made too small or the cervical canal may become stenosed. For amputation the increased dysmenorrhea may be due in part, as has been held by some writers, to the scar which is perpendicular to the long axis of the cervical canal and by contract-ing may cause a narrowing of the canal. This was probably the con-dition in the following history of one of the two cases of amputation in which dysmenorrhea was present only after operation.

Mrs. H. was operated upon by a divulsion and curettage, with dull curette, and the cystic portion of the cervix was excised and the raw edges were coapted with chromic gut sutures, four being used as canal sutures, uneventful recovery, no sec-ondary hemorrhage or unusual vaginal discharge. On discharge from the hospital there was no eversion of the cervical flaps and there was primary union. Some time

later, because of severe dysmenorrhea the cervical canal had to be dilated and a stem pessary introduced. Thus the dysmenorrhea was eventually cured.

4. *Sterility.*—Many factors have to be considered in determining the cause of sterility. Duncan[19] has shown that the age at marriage and the number of years married must be taken into account in our final analysis.

Unfortunately, successful operations on the cervix and vagina often produce increased voluntary sterility. The most frequent cause is the fear, held equally by the patient and her medical adviser and many times by the gynecologist and obstetrician, that labors subsequent to successful plastic operations will result in conditions as bad or even worse than those from which the patient had been relieved. This fear of bearing children, after operation, is shown in our series, as in 72 questionnaires, 84 per cent of the women stated that they were not anxious for more children, 8 per cent acknowledged the use of contraceptive measures and a few had practiced continence. Further there were three elective cesarean sections performed for indications, in part due to the fear of undoing successful repair work or the fear of dystocia due to these operations. In our final analysis of cervical operations and the bearing on secondary sterility, all available facts must be taken into consideration.

Among 149 women in the childbearing period (see Chart 3) under forty years of age at time of operation and menstruating regularly for at least one year after operation, there was sterility of 72.6 per cent for 73 cases of amputation compared to a sterility of 57.9 per cent for 76 cases of trachelorrhaphy or a greater sterility following amputation of 14.7 per cent. In Leonard's series of 101 similar cases there was sterility in 80.6 per cent of 72 amputations compared with sterility of 62.0 per cent of 29 trachelorrhaphies or a greater sterility for amputation of 18.6 per cent. As my series is made up of low, medium and high amputations and there is almost an equal number of cases of amputation and trachelorrhaphy, I believe 14.7 per cent more accurately represents the increase of sterility which follows amputation of the cervix. Therefore, in all cases, where cervical operations are used with other operations a little less than three-fourths of those subjected to amputation remain sterile whereas one and a half times more cases of trachelorrhaphy than amputation were subsequently fertile.

This increase of sterility after amputation in my series cannot be explained on the ground of the different age at marriage or the different number of years married. This is brought out in a classification of the cases which shows that the sterility for trachelorrhaphy when compared with amputation is even less or more nearly corresponds to the percentages established by Duncan. This is true for cervical operations

CHART·4.

A STERILITY AFTER AMPUTATION AND TRACHELORRHAPHY IN DIFFERENT EPOCHS OF MARRIED LIFE. WOMEN UNDER 40 YRS OF AGE AT OPERATION, COMPARED WITH DUNCAN'S PERCENTAGE.

B CERVICAL OPERATION ONLY OR WITH VAGINAL PLASTIC OPERATIONS

CHART·3.

COMPARISON of STERILITY FOLLOWING CERVICAL OPERATIONS WOMAN'S HOSPITAL SERIES

LEONARD'S SERIES
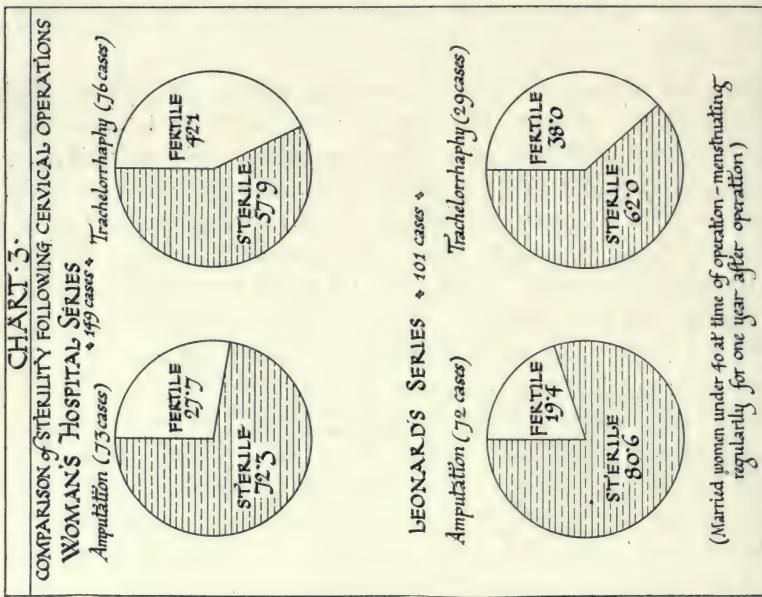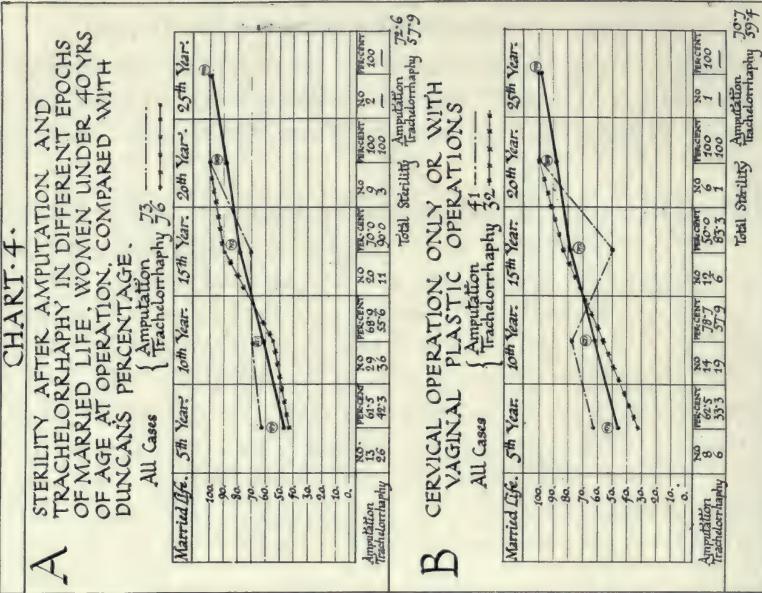
alone or combined only with vaginal plastic operations as it is for the whole series of cases. This is graphically shown, for the different epochs of married life, in Chart 4.

Women in the childbearing period, classified according to different groups of operations (Table II), show 11.3 per cent greater sterility for amputation; for the amputation and trachelorrhaphy combined with

round ligament or uterosacral shortening or ventral suspension or a combination of these operations, it shows 15.2 per cent greater sterility in the cases of amputation; and in amputations and trachelorrhaphy combined with myomectomies, or resections of one or both ovaries, or salpingoöophorectomy unilateral or a combination of these operations there was 18.2 per cent greater sterility for the cases of amputation. Therefore as there is a marked influence of the intraabdominal operations it seems reasonable to exclude these cases and to base our final analysis only on cases in which cervical operations alone or in combination with vaginal plastic work have been done. Thus the increase of sterility for cases of amputation compared to trachelorrhaphy is 11.3 per cent.

TABLE II

Operations Arranged in Groups

	NUMBER OF CASES	FERTILE AFTER OPERATION	STERILITY
A. Cervical Operations alone or with Vaginal Plastic Operations.			
Amputation	41	12	70.7%
Trachelorrhaphy	32	13	59.4%
B. Cervical Operations with Abdominal Operations for Uterine Displacement.			
Amputation	21	7	66.7%
Trachelorrhaphy	33	16	51.5%
C. Cervical Operations with Conservative Abdominal Operations.			
Amputation	11	1	90.9%
Trachelorrhaphy	11	3	72.7%
Totals—			
Amputation	73	20	72.6%
Trachelorrhaphy	76	32	57.9%

5. *Course of Pregnancies after Cervical Operations.*—To determine the cause of abortion, of premature labor, or of dystocia in women who give a history of former easy full-term labors is often a difficult task. Therefore to classify the character of the pregnancies and labors and to assign their cause to different operative procedures, of necessity in different series of women, makes the problem become even more difficult. However, if we compare pregnancies and labors before and after amputation of the cervix and before and after trachelorrhaphy, we are able in each group to establish the influence of operation on the subsequent pregnancies and labors. Then using these facts as a check in comparing the subsequent pregnancies and labors, of necessity in a different series of cases, should give fairly accurate facts as to the occurrence of abortion, premature labor and dystocia as a result of amputation of the cervix or of trachelorrhaphy.

(a) *Premature Labor and Abortion.*—Comparing pregnancies before and after amputation (Chart 5), we find, after amputation, 17.9 per cent fewer full-term labors, and 6.2 per cent more spontaneous abortions. Of the remaining pregnancies interrupted before term

CHART 6.

COMPARISON of PREGNANCIES BEFORE AND AFTER CERVICAL OPERATIONS ALONE OR COMBINED WITH VAGINAL PLASTIC OPERATIONS +

CHART 5.

COMPARISON of PREGNANCIES BEFORE AND AFTER CERVICAL OPERATIONS + Whole Series
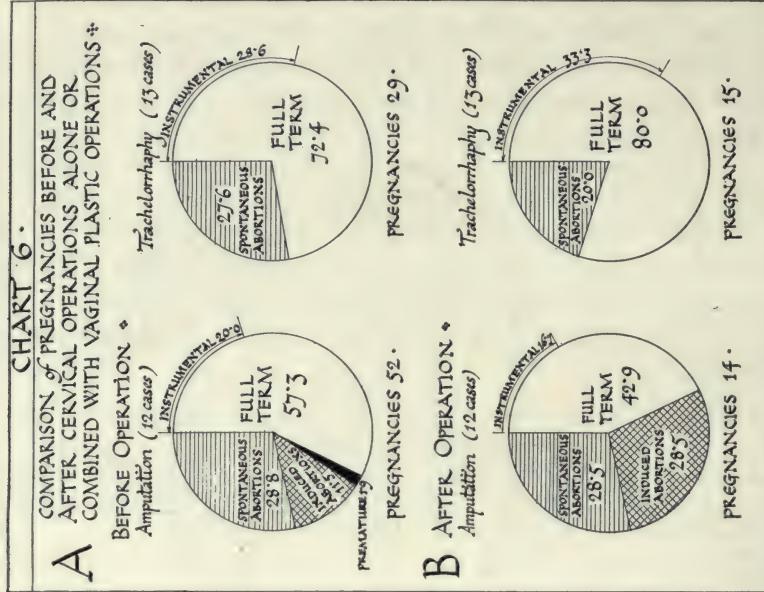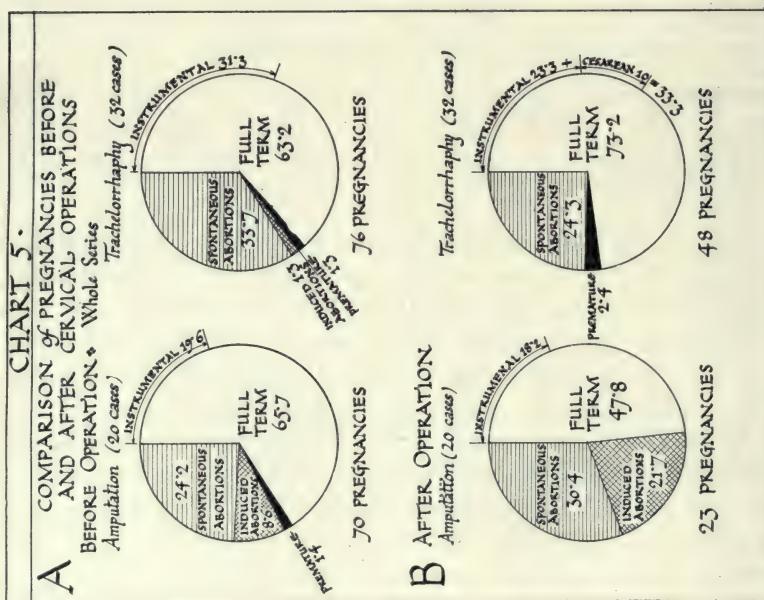
there were, after amputation, no premature labors as compared to 1.4 per cent before operation but there was an increase of two and a half times the number of induced abortions. Comparing the pregnancies before and after trachelorrhaphy we find a 10.0 per cent increase of full-term pregnancies and a decrease of 9.4 per cent in the spontaneous abortions, but twice as many premature labors (1.3 com-

pared to 2.4). Thus in like groups of cases amputation decreases and trachelorrhaphy increases the number of full-term labors while the opposite is true for spontaneous abortions. But premature labor which occurred in an equal percentage (1.3) before operation recurred only after trachelorrhaphy.

With these facts established let us contrast, of necessity in different series of cases, the pregnancies following amputation with those following trachelorrhaphy. There were 25.4 per cent fewer full-term labors, and 6.1 per cent more spontaneous abortions but no premature labors for amputation as compared with trachelorrhaphy which had 2.4 per cent premature labors.

To obtain more accurate statistics let us contrast, in the same way, cervical operations alone or combined with vaginal plastic operations (Chart 6). Comparing the pregnancies before and after amputation we find for the latter cases 14.4 per cent fewer full-term labors and about an equal number of spontaneous abortions. Of the remaining cases interrupted before term we find no premature labors after operation as compared to 1.9 per cent before operation but an increase after operation of over twice as many induced abortions. Comparing the pregnancies before and after trachelorrhaphy we find 7.6 per cent more full-term labors and a decrease of 7.6 per cent of spontaneous abortions. Thus in the same series and like groups of cases amputation decreases and trachelorrhaphy increases the number of full-term labors but while trachelorrhaphy decreases the number of spontaneous abortions amputation has but little effect one way or another, but it is followed by more cases of induced abortions.

Now let us contrast the pregnancies following amputation with those following trachelorrhaphy. There were, for amputation, 37.1 per cent fewer full-term pregnancies and 8.5 per cent increase in the spontaneous abortions and 28.5 per cent of induced abortions with none following trachelorrhaphy. Finally, taking all facts under consideration, amputation of the cervix is more often than trachelorrhaphy followed by the interruption of labor before term, but is no more likely than trachelorrhaphy to be followed by premature labor. While the final analysis of cervical cases alone or with vaginal plastic operations showed for amputation practically no increase of spontaneous abortions yet trachelorrhaphy showed a slight reduction of spontaneous abortions. This confirms the well accepted fact of cervical laceration as a cause of abortion and the reason it does not apply to amputation is in proportion as high amputations occur in the series. While we lack definite records of our high amputations it is reasonably certain that of eleven full-term pregnancies but one followed high amputation and of five spontaneous abortions, with no contributing cause, two of them followed high amputation. This fact is substanti-

ated by Leonard's series of high amputations, which showed the inter-
ruption of pregnancy before term in 64.0 per cent of which 45.0 per
cent were abortions.

(b) *Dystocia.*—In labors before cervical operations our only avail-
able data of dystocia are the use of forceps. Comparing labors
before and after amputation, there is present about the same per-
centage of instrumental deliveries and the labors after trachelor-
rhaphy show a slightly higher percentage of instrumental deliveries
than before operation. The three elective cesarean sections must be
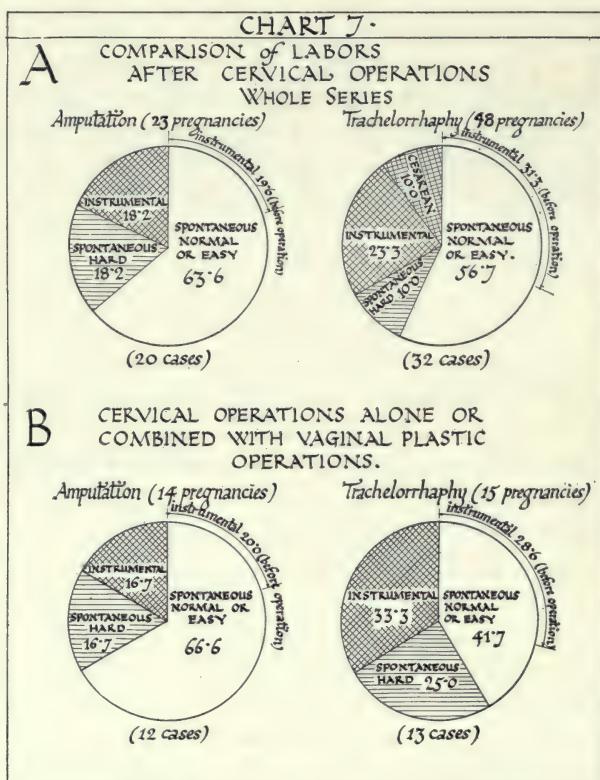
included in this end result as there was an apparent if not an actual
dystocia—the "cervices showing no prospect of safe dilatation."

Comparing labors before and after cervical operations alone or com-
bined with vaginal plastic operations we find after amputation a
slight decrease of instrumental deliveries and after trachelorrhaphy
a slight increase of instrumental deliveries. Note that in this series
there were no cesarean or other operative cases.

For spontaneous labors we have definite data for dystocia only as
it occurred after operation. Thus for amputation we find a slightly
higher percentage of labors classified as spontaneous, normal, or easy.

However, after amputation, compared to trachelorrhaphy, there are about 8.0 per cent more cases classified as hard spontaneous labors but a little more than half as many operative deliveries.

Comparing subsequent spontaneous labors after cervical operations alone or combined with vaginal plastic operations, we find, after amputation as compared to trachelorrhaphy almost 25 per cent more spontaneous easy or normal labors with 8.3 per cent fewer cases classified as hard spontaneous labors and about half as many instrumental deliveries.

Therefore considering dystocia from the data at hand, it is more frequent after trachelorrhaphy than after amputation and I feel it is at its minimum for trachelorrhaphy, as some of the cases classified as spontaneous, normal, or easy deliveries would have shown dystocia but for a laceration of the cervix before full dilatation and for amputation this occurrence was less frequent.

(c) *Relaceration of the Cervix.*—Our statistics are incomplete as to relaceration of the cervix in labors following cervical operations. However, of cases of amputation examined after spontaneous labors 2 of 5 cases, or 40.0 per cent, showed relaceration and for trachelorrhaphy, under similar conditions, 6 of 12 cases, or 50 per cent, showed relaceration.

A review of the following abstracts of pregnancies and labors before and after amputation of the cervix and after trachelorrhaphy will, I believe, substantiate my analysis for dystocia.

CASE REPORTS ILLUSTRATING CASES OF LABOR BEFORE AND AFTER CERVICAL OPERATIONS

I. *Amputation of the Cervix.*

1. *Forceps Deliveries in Subsequent Labors.* (2 of 11 full-term deliveries or 18.2 per cent)

CASE 1.—Mrs. G., twenty-two years of age, married six years. Two full-term labors, first, instrumental in 1911. A 10 pound living child. Second, three years later delivered of a living baby by breech extraction. Unsuccessful perineorrhaphy after first delivery, fever following each delivery.

Amputation of cervix, repair of cystocele and pelvic floor. In the subsequent labor the first stage lasted 11 hours and 35 minutes, with moderate pains, regular, but infrequent. Second stage 2 hours and 44 minutes, pains, strong, regular, frequent but ineffectual. Third stage 6 minutes. Total duration of labor, 14 hours and 25 minutes. Position, L. O. A., at outlet O. A. Complication, prolapsed cord, narrow bi-ischial diameter.

After fourteen hours of labor the head deeply engaged and greatly moulded but there was no progress for two hours although there had been hard pains and the baby was passing some meconium. High median forceps applied and head extracted with great difficulty, median episiotomy on account of scar tissue in the perineum which was beginning to split. Male baby 9 pounds in weight.

NOTE: Dystocia was not due to the amputation of the cervix but to the large size of the child and to pelvic contraction as her previous labors were hard, first instrumental and second a breech, and there was a distinct narrowing of the bi-ischial spines.

CASE 2.—Mrs. N., 26 years, married 6 years, two children, no abortions or miscarriages. First labor, 1914, dry, spontaneous, 9½ hours, with male child, 7 pounds, 12½ ounces. Second labor, 1916, dry, spontaneous, 9 hours, male child, 8 pounds and 15 ounces. Operation, January 26, 1917, median amputation of cervix, repair of pelvic floor, Alexander's operation.

Subsequent dry labor with no real pains until the end of 14½ hours, when the cervix was fully dilated. Position L. O. P., converted and after pituitrin 1 c.c. and strychnine 1/20 by hypodermic, the pains became regular, frequent and effectual. Later, after an interval of three and a quarter hours there was no advance of the labor and low forceps were applied and a male child, 9 pounds and 14 ounces, was delivered. Total duration of labor, 18 hours and 3 minutes. First degree perineal tear.

NOTE: This labor was twice as long as either previous delivery due to the L. O. P. position, large baby and the lack of real labor pains but the cervix was not the cause of dystocia as it was fully dilated without effectual pains and without the aid of the bag of waters.

2. *Hard Deliveries in Subsequent Labors.* (2 of 11 full-term deliveries or 18.2 per cent)

CASE 1.—Mrs. McK., thirty-four years, admitted August 27, 1917. Married three years, never pregnant. Chief complaint, procidentia and cervical growth. Operation for cystocele, median amputation of cervix, transposition of uterosacral ligaments (Jellet's Operation) and repair of pelvic floor. Result partially satisfactory. Readmitted four months later because of retroversion of uterus and vaginal prolapse. Second operation for cystocele, Alexander's for retroversion and repair of pelvic floor.

Subsequent labor, 2½ years after last operation. Membranes ruptured spontaneously and labor lasted 10 hours and 40 minutes. In three hours and fifteen minutes from the beginning of labor, the cervix was dilated three fingers. Pituitrin M 10 at end of second stage and a female child, 7 pounds and 6 ounces, was delivered. Immediately following birth of head there was a sudden gush of blood, inspection revealed lacerations of anterior and right lateral walls of vagina; as well as around the urethra, posterior wall intact. The laceration of anterior wall about 3 inches in length. Lacerations sutured and vaginal pack placed.

Readmitted to hospital on September 21, 1920, and a vaginal hysterectomy, with over-lapping of broad ligaments and the fascia of anterior wall and a repair of pelvic floor was done.

NOTE: The unhappy sequelae in this case were not due to the amputation of the cervix but to the extensive and frequent operations and possibly to the injudicious use of pituitrin.

CASE 2.—Mrs. P., twenty-seven years, married 3 years, two spontaneous, hard labors, no abortions or miscarriages. Operation, 1918, amputation of cervix and repair of pelvic floor. Subsequently she had what she terms a hard full-term spontaneous delivery.

NOTE: Unfortunately this case was followed up only by a questionnaire, but as there is subjective evidence of the nature of her labors, it is reasonable to assume the hard labors before operation, and the hard labor subsequent to operation were due to the same cause and not to amputation of the cervix.

3. *Easy Deliveries in Subsequent Labors.* (7 of 11 full term deliveries or 63.6 per cent)

There were seven full-term deliveries in which the subsequent labors were classified as normal or easy. In three of these cases there were previous operative deliveries. In one of these with two previous forceps operations of long duration, the subsequent delivery was spontaneous and two hours in duration. At the ninth month the cervix admitted one finger and at the onset of labor the cervix was three fingers dilated. Of the two others with previous single full-term deliveries, both instrumental, one had a subsequent delivery at full term of nine hours' duration and the other an easy subsequent full-term delivery.

Of the four remaining cases with spontaneous labors before and after operation we have the following: In two there were premature labors at the seventh month and in one the subsequent labor was easy, of fifteen hours' duration and in the other there was a subsequent precipitate labor. In the remaining two cases, one with three previous spontaneous normal labors of an average duration of twenty-four hours each with a subsequent normal labor of twelve hours and the other with seven normal previous labors with a subsequent normal labor.

From a study of subsequent labors in cases of amputation of the cervix, we must question the statistics of others who claim a high percentage of subsequent dystocia and premature labors after this operation.

II. Trachelorrhaphy.

1. *Forceps Deliveries in Subsequent Labors.* (7 of 30 full-term deliveries or 23.3 per cent)

CASE 1.—Mrs. R., 24 years, one instrumental full-term stillbirth. Operation, divulsion and curettage, trachelorrhaphy, repair of pelvic floor, and appendectomy. Two years after operation, delivered at full term after manual dilatation of cervix and median forceps of a living baby boy weighing 7½ pounds. Presentation vertex R. O. A.

NOTE: Both the previous and subsequent deliveries were instrumental but the latter resulted in a live baby after the dystocia of cervix was overcome by dilatation.

In six cases, with instrumental deliveries in their subsequent pregnancies, all had had full-term pregnancies, before trachelorrhaphy, terminated by instruments. In four of these there were single previous full-term pregnancies which resulted in stillbirths although the subsequent pregnancies all resulted in live babies. Of these cases but three were re-examined and two showed a relaceration of the cervix. Of the remaining cases each with two previous pregnancies, one with an instrumental and spontaneous birth with subsequent instrumental delivery and the other with previous instrumental delivery and an abortion with subsequent instrumental delivery.

NOTE: In none of these was the duration of labor or the kind of operative delivery more severe than in previous deliveries and in a few, it was less severe. However, there was slight dystocia from the repaired cervix in over 42 per cent; in one manual dilation was done and in two there was relaceration of the cervix.

1. (a) *Elective Cesarean Section in Subsequent Labors.* (3 of full-term deliveries or 10 per cent)

CASE 1.—Mrs. D., twenty-six years, one full-term pregnancy, baby delivered by a forceps operation of long duration. Operation, divulsion and curettage, trachelorrhaphy, repair of pelvic floor, shortening of round ligaments and appendectomy. Two years later patient delivered, at term, by cesarean section because of extensive perineal and cervical repair following previous labor. The cervix showed no prospect of safe dilatation and there was a large unengaged head. Living male baby weighing 8 pounds and 11 ounces.

CASES 2 and 3.—These two sections were in successive pregnancies in the same patient. Mrs. A., thirty-four years, married ten years. Four full-term, normal deliveries. Operation, trachelorrhaphy, repair of pelvic floor, resection of left ovary and appendectomy. In the following three years patient was delivered twice, at term, by elective cesarean section for a large baby and a cervix which did not promise satisfactory dilatation and also to avoid possible extensive injury to the small parts.

NOTE: In all three of these cases there was an apparent dystocia due to the trachelorrhaphy.

2. *Hard Deliveries in Subsequent Labors.* (3 of 30 full-term labors or 10 per cent)

CASE 1.—Mrs. E., thirty-four years, married eighteen years. Four spontaneous full-term children and two abortions. Last child seven years ago and last abortion four years ago. Operation, divulsion and curettage, trachelorrhaphy and repair of pelvic floor. Subsequent labor was at full term and patient reported in her questionnaire that it was a ''hard labor.''

CASE 2.—Mrs. L., thirty years, married seven years. Four years ago a full-term 7 pound baby delivered by a spontaneous easy labor of two hours' duration. Operation, divulsion, curettage and trachelorrhaphy. Three years later or seven years after first pregnancy delivered of a 7½ pound baby by a long labor of twenty hours due to slow dilatation of cervix which was slightly lacerated.

CASE 3.—Mrs. C., twenty-two years, married four years, two full-term, normal spontaneous labors, last two years ago. Operation, curettage, trachelorrhaphy and removal of urethral caruncle. One subsequent full-term labor referred to by the patient as a ''hard slow labor.''

NOTE: Thus in the three cases in which previously only normal labors occurred there were subsequent hard labors. This was unquestionably due to a prolonged first stage due to slow dilatation of the cervix. In two a trachelorrhaphy alone was done and in the third a trachelorrhaphy and repair of pelvic floor.

3. *Easy Deliveries in Subsequent Labors.* (17 of 30 full-term deliveries or 56.7 per cent)

CASE 1.—Mrs. M., thirty-two years, married seven years. One full-term labor terminated by a hard instrumental delivery resulting in extensive cervical laceration and complete tear through the sphincter. During early months of her pregnancy the uterus was prolapsed. Subsequently patient had two abortions the last one followed by curettage. Operation, divulsion and curettage, repair of complete laceration of pelvic floor and trachelorrhaphy. Three years later delivered of male child weighing 7 pounds and 14½ ounces. Membranes ruptured spontaneously one hour before pains were established. Duration of labor two hours and thirty minutes. Hemorrhage, sixteen ounces in amount, immediately after third stage. Inspection revealed a right lateral laceration of the cervix extending up into broad ligament, which necessitated immediate suturing with three chromic gut sutures to control the hemorrhage.

CASES 2 AND 3.—Both of these subsequent normal labors occurred in the same patient. Mrs. C., twenty-six years, married three years. One full-term labor of forty-eight hours' duration, which was terminated by forceps. This was followed by four spontaneous abortions. Operation, trachelorrhaphy, repair of pelvic floor, shortening of round ligaments and appendectomy. In the following five years there were two full-term labors. The first was normal and spontaneous but was followed

by relaceration of the cervix. The second was a breech extraction of a 6 pound 2 ounce female baby. Duration of labor, 8 hours and 13 minutes.

NOTE: Of the above three subsequent deliveries the easy and short duration can be accounted for in the first by the relaceration instead of dilatation of the cervix, and the same thing can be said for the first labor of the second case. As to the third case the cervical repair had given away in the previous labor. Therefore it seems to me that there was dystocia due to the trachelorrhaphy.

Five of the remaining cases with instrumental deliveries in previous labors had subsequent easy or normal deliveries as follows: (a) Previous operative delivery, with stillbirth, and subsequent easy labor; (b) previous 27 hour instrumental delivery with subsequent 7- or 8-hour normal labor with relaceration of cervix; (c) previous instrumental delivery with a subsequent easy, normal labor; (d) previous instrumental delivery of 10 hours' duration and a premature, 8 months' baby, with a labor of 1 hour; subsequently a full-term spontaneous delivery of 2 hours' duration; (e) previous instrumental delivery of 24 hours' duration and a second pregnancy ending in an abortion with a subsequent premature delivery at the thirty-seventh week of gestation. Nine of the remainder of the seventeen cases had previous and subsequent normal or easy deliveries but one of these cases should be excluded as there had been a failure of the trachelorrhaphy due to secondary hemorrhage and secondary union.

NOTE: Of the 17 subsequent labors, one a premature following trachelorrhaphy, there is definite information in regard to relaceration in but 7, or 41.1 per cent. However, from this I am inclined to believe that the dystocia may not be apparent but that if all trachelorrhaphy cases were examined after subsequent easy labors, laceration would be more often found.

CONCLUSIONS

1. Amputation of the cervix and trachelorrhaphy are effectual and adequate operations and have a definite place in the gynecology of today.

2. Secondary hemorrhage and secondary union occur more often after trachelorrhaphy and are due rather to faulty technic than infection.

3. Improvement in the general health occurs in over 82 per cent of the cases for each operation but it is greater after amputation of the cervix.

4. Amputation of the cervix is more efficient than trachelorrhaphy in the cure of leucorrhea and dysmenorrhea but is more often the cause of these symptoms in cases previously free of vaginal discharge and menstrual pain.

5. Voluntary sterility is increased by cervical and vaginal plastic operations, but, all things being equal, there is 11 per cent greater sterility after amputation of the cervix than after trachelorrhaphy.

6. Amputation of the cervix is more often than trachelorrhaphy followed by interruption of labor before full term but is no more liable to end in premature labor than trachelorrhaphy. Abortion is more frequent after amputation in proportion to the number of high amputations.

7. Dystocia is greater after trachelorrhaphy both as to the number of operative deliveries and of difficult spontaneous labors.

8. With proper indications and technic, low, or medium amputation is as applicable as trachelorrhaphy to women in the childbearing age.

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350 WEST EIGHTY-EIGHTH STREET.

THE PATHOLOGY OF UTERINE BLEEDING IN 100 ANALYZED CASES*

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BLEEDING from the uterus, aside from that of menstruation, occurs together with a great number of pathologic lesions of the female pelvic organs. Occurring under these varied conditions of pelvic pathology, it is difficult to diagnose the cause of the bleeding in every case.

For the study of uterine bleeding the histories of 100 cases of this affection were taken from the records of the Woman's Hospital. These histories and pathologic findings were carefully studied and made the basis of this paper. The clinical investigation of the cases convinced me early in the study that uterine bleeding must be classified under six different groups, as in each group there is a definite etiological factor causing the bleeding. On the basis of these etiological factors the classification was made and the six groups of cases so classified are shown in Chart I.

Clinically every case of uterine bleeding can be classified under one of the above groups. It is obvious, however, that some cases of uterine bleeding may have one or more causative factors given in Chart I active at the same time. For example, a patient may suffer with an infection, may have a neoplasm in the uterus and be harassed with endocrine distress, or a pathologic gestation may be present coexistent with a neoplasm and infection. Under these complex pathologic conditions it would indeed be difficult to state the precise cause of the uterine bleeding. This is a very important fact to consider, and the study of these 100 cases of uterine bleeding brings out this fact very forcibly. The cases of uterine bleeding should be grouped according to what the clinician considers the most prominent symptoms in the case, and what he considers the most prominent, etiologic factor.

When a case of persistent uterine bleeding presents itself, before deciding on the therapeutic measures for relief, an endeavor should be made to place the case into one of the six groups enumerated above. By doing this the clinician will have made a very important step toward giving proper therapeutic measures for the relief and cure of the case in question.

The study of the 100 cases of uterine bleeding has brought to light many interesting facts. I shall take up each group of cases by itself and point out the cause of the bleeding.

Pregnancy.—In the first group where gestation was the etiologic factor in the uterine bleeding, eight out of thirteen had retained secundines, the removal of which by curettage brought prompt relief.

Several interesting facts came to light by the study of this group, which I shall give here in detail, as I consider these facts of some importance.

In two cases, Nos. 7 and 36, an early abortion occurred five weeks before the cases came under observation. The patients complained of a metrorrhagia of five weeks' standing. Pelvic examination was negative. Curettage brought away a very small piece of retained secundines in both cases and the rest of the curettings showed as the pathologist expressed

CHART No 1.
100 CASES OF UTERINE BLEEDING
Classified in 6 Groups

Group	Etiology	Pathology	Number of Cases
1	Pregnancy	Abortion. Uterine Mole. Hydatidiform Mole. Chorio-Epithelioma. Diseases of Placenta. Pathologic Implantation of Ovum. Ectopic Gestation. Malposition of Placenta.	13
2	Infection	Endometritis. Metritis. Salpingitis. Oophoritis.	23
3	Neoplasms of Uterus & Ovaries	Polypoid Conditions of Uterus and Cervix. Fibroids. Carcinoma and Sarcoma Polyps. Ovarian Neoplasms.	38
4	Displacements Lacerations Congestion	Retroversion, Inversion of Uterus Subinvolution. Lacerations. Prolapsus Uteri.	13
5	Endocrine Distress	Hyper-function of Ovaries Hypo-thyroidism. Disease of Hypophysis and Adrenals etc. Disturbed Balance of Function of Ductless Glands.	9
6	Constitutional Causes and Blood Diserasie	Cardio-Vascular Disease Nephritis. Phthisis. Infectious Diseases, Rheumatoid Conditions Anaemia. Chlorosis. Pernicious Anaemia.	2
		Records incomplete	2
		Total	100

it, "typical premenstrual mucosa." These cases bring out the fact that after abortion, the uterine mucosa regenerates promptly preparatory for the normal menstrual cycle of the coming month, in spite of the fact that the uterine cavity harbored a small portion of retained secundi.

No. 29 was also an interesting case in this group. The patient was forty-three years old and had three children. Examination showed a fibroid of the uterus, a cervical polyp and there was a history of an abortion. On account of the abortion the case was placed in the first group instead of the third, under neoplasm. A curettage resulted in a cure of the uterine bleeding of five weeks' standing. The pathologist made the following report: "decidua compacta and spongiosa, adenoma polyposum of the cervix. Polyp shows large cervical glands of the hyperplastic type." The cause of the uterine bleeding was retained

secundines, the polyp and fibroid having nothing to do with the bleeding.

In this group of uterine bleeding there were three cases due to ectopic gestation, Nos. 4, 9, and 58. The pathologist shows two interesting facts in the specimens. In Case No. 9, the gestation occurred in the remnant of the fallopian tube, that had been resected at a previous

Uterine Bleeding

CHART No II

PREGNANCY, 13 CASES

Pathologic Report

No	Endometrium	Uterine Glands	Uterine Tubes	Ovaries	Duration of Uterine Bleed.	Age	No. of Pregnan's	Operation
4	Not stated	Not stated	Ectopic	Normal	4 Wks	27	2	D&C Trachelorrhaphy Left Salpingectomy Ectopic Vent. Susp. Amp
7	Premenstrual History of Abortion	Premenstr'l	Normal	"	2 Months	25	1	Divulsion & Curettage
9	Not stated	Not stated	Ectopic in stump of Tube	"	1 Year	31	None	Removal of stump of tubes previously resected
19	Placental tissue	"	Normal	"	1 Month	29	3	Spontaneous expulsion of Foetus & Placenta
23	Low impl'td Placenta	"	"	"	3 "	20	1	No Operation Pregnancy
25	Retained Secundinae		"	"	1 "	30	3	Divulsion & Curettage
29	Dec. compl. Spong order pap	Hyperplastic glands of Cervix	"	"	1 "	43	3	Removal of polyp. Divulsion & Curettage
36	Premenstrual History of Abortion	Premenstrual	"	"	6 Wks	32	4	Divulsion & Curettage
40	Chorio-Epithelioma	Not stated	"	"	"	27	None	Pan-Hystero bil. salpingo-oophorectomy
42	Retained secundi.		"	"	3 Months	29	?	Divulsion & Curettage
50	Normal	Normal	"	"	6 Wks	39	7	Spontan's expulsion of Foetus & Placenta
58	Round cell Infiltration	Distorted Glands	Ectopic	"	2 Months	29	2	D&C Repair of Ant. Vag Wall. Bil. Salpingectomy
100	Early Placenta	Not stated	Normal	"	6 Wks	29	4	D&C Trachelorrhaphy

Summary of Causes of Uterine Bleeding in 13 Cases

4 Causes

	CASES	
1	8	Abortion Nos 7-19-25-29-36-42-50-100
2	3	Ectopic Gestation 4 - 9 - 58
3	1	Low Implanted Placenta 23
4	1	Chorio-epithelioma 40

operation. Ectopic gestation in stumps of resected tubes has been observed repeatedly. It seems to me therefore, in the light of these repeated observations, that resection of the uterine tubes is a very questionable procedure. It is a question whether a resected tube is ever a functionating organ. A resected tube appears to be more of a menace to the individual than a benefit. In this case the patient was thirty-one years old. She had one child. She was laparotomized for chronic sal-

pingitis and had the right tube resected. Four years later an ectopic gestation occurred in the resected tube. An interesting question arises, in the light of these observations, how does the fecundated ovum reach the remnant of a resected fallopian tube? I have, as others have, repeatedly observed in reopened abdomens, that the resected tube was firmly adherent to the broad ligament and no osteum existed. Therefore, if such are the facts, a fecundated ovum can only reach this remnant of the tube by way of its open uterine end, by migration through the opposite tube. The pathologist says: "section of the tube stump shows early pregnancy, with double layer of epithelioma on surface." This shows conclusively that the tube was adherent, and one would hardly expect to find an open distal end of a tube so adherent.

In the second case, No. 58, the patient was twenty-nine years old and had two children. She had a metrorrhagia of two month's duration. She had the following operations: divulsion and curettage, repair of anterior wall, bilateral salpingectomy, ectopic on right side. The pathologist makes the following report: "Chronic endometritis. Tubal gestation. Tube contains blood clots. Section of tube shows fairly well preserved chorionic villi. Section of curettings shows remnants of mucosa with numerous round cells in the stroma and a few distorted glands."

This case of ectopic gestation is here reported because a bilateral salpingectomy was done. This brings up an important question, namely, under what conditions should the opposite fallopian tube be removed in operating for ectopic gestation? It is in the experience of every gynecologist that in ectopic gestation the fallopian tube opposite to the gravid one, looks congested, thickened and engorged. It is very difficult to say if the tube is diseased or normal. It is very frequently a difficult problem to decide, while the abdomen is open, what it is best to do. Is there anything that can guide one in deciding what best to do to avoid the mistake of removing a normal tube or leaving behind a diseased one?

On two very important occasions this question confronted me. The tube opposite to the ectopic looked diseased, with a gonorrheal history, behind the ectopic. I decided against a salpingectomy and I am glad to say that in one of these cases, since the operation, two children were born, while in the second case no symptoms of pyosalpinx developed so far although no pregnancy has occurred. In both of these cases the removal of the tubes was seriously contemplated at the time of operation and I refrained from doing so only on account of the youth of the patients. I should advise against salpingectomy of the opposite tube in ectopic gestation in the light of my own experience, and should remove the opposite tube only in those cases where the tube is so hopelessly diseased that it is beyond the possibility of natural repair.

What is the cause of the uterine bleeding in this group of cases? In the abortion cases the uterine bleeding is readily understood. Tissue changes and cell destruction result in the escape of blood and hence the uterine bleeding. In the early months of pregnancy before the placenta forms, faulty implantation results in tissue destruction and a necessary escape of blood. After the placenta has formed bleeding may occur from disease of the placenta or faulty position, or the placenta may undergo changes like in the chorioepithelioma. In tubal gestation the bleeding may occur from two sources. First from the gestation sac itself as a result of faulty implantation, the blood reaching the uterine cavity by way of the patent uterine end of the tube, or secondly the uterine bleeding may have its source from the endometrium, a proliferation having taken place in the endometrium as a result of the tubal gestation.

Infection.—In the second group of cases where infection was the etiologic factor there were 23 cases. A noteworthy feature in this group is the fact, that in every specimen subjected to pathologic examination the endometrium showed pathologic changes. Chart III shows these pathologic changes in detail in the 23 cases belonging to this group. In four cases out of 23 a polypoid condition of the endometrium was encountered. In 11 cases out of 23 chronic endometritis was found. In two cases the endometrium was found edematous, thick and pale. In one case the pathologist reports that the endometrium showed various phases of menstruation. The fallopian tubes had round-cell infiltration in four cases. Hydrosalpinx was present in two cases, pyosalpinx three times and in 11 cases the tubes were found normal. The ovaries showed cystic degeneration in four cases. In 18 cases the ovaries were normal. In one case the ovaries were carcinomatous.

From this summary it is very obvious that in cases with menstrual disturbance and uterine bleeding where infection is the etiology, 20 per cent show a polypoid condition of the endometrium; 55 per cent an inflammatory condition of the endometrium with round-cell infiltration and the remaining 25 per cent have various other pathologic disturbances. Endometrial pathology is evidently the most frequent cause of uterine bleeding in infection of the female generative organs. The onslaught of the infection is borne by the endometrium which has to bear the brunt of the attack of the microorganisms, and although the uterine glands and endometrium undergo a physiologic regeneration from month to month, the endometrium cannot entirely throw off the invasion of the microorganisms and get rid of the inflammatory exudate, which is present in the form of a round-cell infiltration in over 55 per cent of cases.

That this is a correct interpretation of the pathologic findings in

Uterine Bleeding
CHART No III-a
INFECTION   23 CASES
Pathologic Report

No	Endometrium	Uterine Glands	Uterine Tubes	Ovaries	Duration of Uterine Bleeding	Age	No. of Pregn's	Operation
3	Endometritis, Thick polypoid growth; oedematous, recent thrombism	Interval type	Normal	Normal	4 Months	39	2	Pan-Hysterectomy Bil. Salpingo-oophorectomy
6	Adenoma polyposum	Hyperplastic	Rd cell infiltration	Carcinoma	2 Years	50	3	Pan-Hysterectomy Bil. Salpingo-oophorectomy
12	Myoma polyposum	Premenstrual	Hydrosalpinx	Normal	3 Months	45	0	Supr. vag. Hysterect. Bil Salpingo-oophorect
15	Round cell infiltration	Interval type	Inflammation Rd cell infiltration	Fol cysts	2 years	21	0	Supr vag Hysterect. Bil. Salpingo-oophorect
18	Various phases of menstruation	Various phases of menstruation	Pyosalpinx	Fol cysts	2 Weeks	46	1	Hysterectomy Bil salp-oophorect
27	Oedematous, thick and pale	No change	Granulation tissue	Normal	3 years	44	1	Hysterectomy
30	Ch. Hemorrhagic Endometritis	Premenstrual changes	Normal	"	7 "	32	3	Pan-hysterectomy Left salpingo-oophorectomy
31	Oedema	Hyperplasia	"	"	6 Months	39	2	Pan-hysterectomy Bil. Salp-oophorect
33	Thickened. Polyp. Rd. cell infiltration Hyaline degeneration	"	"	"	2 years	46	7	Pan. hysterect Bil.salp.-oophorect
39	Ch. Endometritis Rd cell infiltration	"	"	"	1 Month	26	1	D&C cured
45	Ch. Endometritis "	Hyperplastic Rd.cell infiltration	"	"	6 Weeks	30	0	D&C
47	Ch. Endometritis "	"	"	"	5 "	21	1	D&C Pessary
48	Round cell infiltration Hyperplastic	Hyperplastic	"	"	1 Year	41	3	D&C Good result
51	Not observed	Not observed	Thickened Rd cell infiltration	"	6 Months	31	3	Bil. salpingectomy Good result
53	Ch. Endometritis Rd. cell infiltration Hyaline degeneration epensal wall	"	Normal	"	6 "	32	2	Vag. hysterect Left Salp-oophorect
54	Not observed	"	Diseased Ch.pen.salpingitis	"	4 "	28	0	Left salpingectomy Short round lig Appendix
61	Not observed	"	Sub-acute Salp. Rd cell infiltration	"	5 years	23	0	Bil salpingectomy
65	Not stated	Not stated	Buried in adhesions	Buried in adhesions	11 "	30	2	Freeing of adhesions of adnexae Removal of cyst Hydatid of Morgagni
76	Ch. Endometritis Round cell infiltration	"	Normal	Normal	6 Months	28	0	D&C & Radium
83	Hyaline degeneration	Hyperplastic	Hydrosalpinx	Pol.cysts	Many years	49	4	Hysterectomy Bil Salp-oophorect
86	Ch. Endometritis Rd. cell infiltration	"	Pyosalpinx	"	3 Weeks	19	0	Hysterectomy Bil salp-oophorect
90	Ch. Endometritis Rd cell infiltration Oedematous	Distorted Hyperplastic	Normal	"	4 "	21	1	D&C Good result. no bleeding
99	Not observed	Not observed	Pyosalpinx	Hemorr Corpus luteum	6 "	29	4	Bil salpingectomy RT-oophorectomy Myomectomy

CHART No III-b

Summary of Causes of Uterine Bleeding in Cases of Infection
2 Causes

1	55%	11	Endometritis Nos 15-30-39-45-47-48-53-76-83-86-90
2	19%	4	Polypoid Condition of Endometrium Nos 3-6-12-33
		1	Various Phases of Menstruation No 18
		2	Oedema of Endometrium Nos 27-31
		5	Not observed Nos 51-54-61-65-99
		23	

Uterine Tubes

45%	11	Normal Nos 3-30-31-33-39-45-47-48-53-76-90
	2	Hydro-salpinx Nos 12-83
	3	Pyo-salpinx Nos 18-86-99
	4	Round Cell Infiltration Nos 6-15-51-61
	3	Chronic Salpingitis Nos 54-65-27
	23	

Ovaries

80%	18	Normal Nos 3-12-27-30-31-33-39-45-47-48-51-53-54-61-65-76-86-90
	4	Cystic Nos 15-18-83-90
	1	Carcinoma No 6
	23	

these cases is further borne out by the study of the cases tabulated in Chart III. In 45 per cent of the cases of uterine bleeding the uterine tubes were found normal and the ovaries were normal in 80 per cent

of the cases. In Case No. 3, the patient 39 years old, who had two children, was suffering with a metrorrhagia of four months' duration. A panhysterectomy and a double salpingooophorectomy was done. When the specimen was examined both tubes and both ovaries were found normal. The endometrium was found diseased and presented a thick polypoid growth, which was edematous and had thrombosed vessels. In this case the metrorrhagia was due to the polypoid growth in the endometrium, supplemented or perhaps aggravated by the endometritis. Again in Case 30, a woman 32 years old, with a history of metrorrhagia off and on for seven years, was operated on, and the specimen showed normal tubes and ovaries, with a diseased endometrium to account for the repeated attacks of metrorrhagia of many years' standing.

Taking these facts into consideration one is justified in concluding that uterine bleeding in cases of infection is due to pathologic changes in the endometrium in the form of an infection, and that a certain number of cases of uterine bleeding are due to a polypoid condition of the endometrium, which occurs in at least 20 per cent of cases. This brings up an important question, namely, that of curettage for metrorrhagia in cases with a history of infection. The teaching has been that curettage should not be practiced in cases of infection. This is a very sane teaching, as during curettage the protective leucocytic layer which acts as a bar to the further spread of infection, is removed by the curette. Nevertheless, in view of the fact that nearly every endometrium is diseased in cases of metrorrhagia with history of infection, a curettage should be performed in every case of metrorrhagia where the operator does not contemplate the removal of the uterus.

Cases 39 and 61 bear upon this subject and bring out another interesting point in reference to curettage. In Case 39 a young woman 26 years old, with one child, was suffering with a severe metrorrhagia of one month's duration. Her uterine adnexae were apparently normal. She was curetted and the specimen showed endometritis with round-cell infiltration. Subsequent history showed that she was relieved of all symptoms. In contrast to this case of beneficial curettage is Case 61.

She is also a young woman twenty-three years old, who has been suffering with repeated attacks of metrorrhagia for five years. She was laparotomized and a bilateral salpingectomy done. The specimen showed subacute salpingitis and round-cell infiltration. She was not curetted and while she is relieved of the symptoms of salpingitis her metrorrhagia did not improve and a curettage is indicated for relief of symptoms. A curettage at the time of operation would have been the proper procedure. In these cases the sharp curette, which is the instrument to be used, removes pathologic tissue debris, and in that way benefits the condition. Whether the curettage is of temporary or of

permanent benefit is another question.   There is, however, no doubt that the temporary benefit of the curettage is certain and definite.

Neoplasms.—Under the third group, there were 38 cases, tabulated in Chart IV.   The study of this chart shows that there were eight cases of cancer of cervix; 26 cases of fibroids and four cases with uterine polyps.   The endometrium was affected in nearly every one of the 38 cases.   What was the cause of the uterine bleeding in these cases?   In eight there was the cell destruction which is present in all carcinomas. In Case 72 there was a history of uterine bleeding for a year, in a

Uterine Bleeding
CHART No IV-a
NEOPLASMS 38 CASES
Pathologic Report

No	Uterus	Cervix	Endometrium	Uterine Glands	Uterine Tubes	Ovaries	Duration of Menorrhagia	Age	Number of Pregnancies	Operation
1	Normal	Carcinoma	Hyperplastic	Hyperplastic	Normal	Normal	4 Months	62	2	D&C, Radium 100 mg 24 hrs
5	Carcinoma	Carcinoma	Carcinoma	Carcinoma	"	"	3 Months	58	None	Radium Application
8	"	"	Atrophic	Atrophic	"	"	1 "	40	1	" "
10	"	"	Carcinoma	Carcinoma	"	"	3 "	31	None	" "
14	"	"	"	"	"	"	3 "	36	4	" "
17	Fibroid	Normal	Adeno-myometritis	Penetrate Muscularis	"	Fol. Cysts	3 years	35	None	Supra-vag. Hysterectomy Rt. Salpingo-oophorectomy
20	Adeno-myoma	"	No inflammatory changes	Penetrate Musculature	"	"	3 "	42	"	Supra-vag. Hysterectomy Bil. salpingo-oophorectomy
21	Polyp at Fundus	"	Round cell Infiltration	Not stated	"	"	3 Months	40	"	Pan hysterectomy Left salpingo-oophorectomy
22	Several Fibroids	"	Thickened	Premenstrual Changes	Diseased	"	2 "	44	2	Supra-vag. Hysterectomy Bil. Salpingo-oophorectomy
24	Carcinoma	Carcinoma	Carcinoma	Not stated	Normal	"	2 "	42	2	Radium Application
32	Large Myoma sub-mucous	Normal	Pale and hemorrhagic	" "	Hyperaemic	Hemorrhagic Cysts	6 "	56	4	Supr. vag. Hysterectomy Bil. Salpingo-oophorectomy
35	Uterine Polyp	Polyp protrudes	Premenstrual Mucosa	Premenstrual	Normal	Normal	10 "	45	4	Removal of Polyp Radium Application
41	Fibroids	Normal	Oedema polyposum	Hyperplasia	"	Corpus luteum Cyst	1 year	Not stated	0	Supr-vag. Hysterectomy Bil. Salpingo-oophorectomy
43	Carcinoma	Carcinoma	Carcinoma	Carcinoma	"	Normal	2 Months	56	1	Radium Application
44	Fibroids	Polyp protrudes	Interval	Interval	"	"	3 "	48	2	Removal of Polyp and Radium Application
46	Large Fibroids	Normal	Thickened	Premenstrual	Thickened Round cell infiltration	Large cyst Hemorrhagic	8 years	34	1	Supra-vag. Hysterectomy Bil.salp-oophorectomy
49	Fibroids	"	Hyperplasia	Hyperplasia	Normal	Corpus luteum Hemorrhage	6 Months	38	None	Supra-vag. Hysterectomy RC. salp-oophorectomy
56	Sub-mucous Fibroid	"	Thickened oedematous	Normal	"	Cyst	3 "	47	"	Supra-vag Hysterectomy Left salp-oophorectomy
62	Multiple Sub-mucous Fibroids	"	Thin	Cystic Glands	"	Ov. Cyst	1 year	39	"	Supra-vag. Hystero - Bil. Salpingo-oophorectomy
66	Fibroids	"	Very thin destroyed by Iodin	Not stated	"	Normal	9 "	39	3	Pan- Hysterectomy Bil.salp-oophorectomy
67	"	"	Thin No other change	"	Hydro-salpinx flattened plicae	"	2 "	43	None	Supra-vag Hysterectomy Bil.salp-oophorectomy
68	"	"	Hemorrhagic Oedematous	Premenstrual	Normal	"	3 "	43	1	Supra-vag Hysterectomy Bil.salp-oophorectomy

woman 45 years old, the clinical diagnosis was carcinoma of the cervix, but the pathologist reported only necrotic tissue.   The clinical diagnosis is the correct one.   The pathologist did not receive a proper specimen for examination.   Subtracting the eight cases of carcinoma, where the cause of bleeding is well known and readily understood, there are left 30 cases of fibroid of uterus, for the study of the cause of uterine bleeding.

Careful analysis shows that in the 30 cases of fibroids, the neoplasm was responsible for the bleeding in only 17 cases or in 55 per cent. In 11 cases out of the 30 the cause of the bleeding was infection of the

endometrium, the tumors having nothing to do with the bleeding. In other words, in 35 per cent of cases of fibroids of the uterus, the disturbance in menstruation and uterine bleeding is not caused by the neoplasm but is due to infection of the uterine endometrium, the cause of the bleeding being precisely the same as in cases of infection of the generative organs, namely diseased endometrium.

CHART No IV-b

No	Uterus	Cervix	Endometrium	Uterine Glands	Uterine Tubes	Ovaries	Duration of Metrorrhagia	Age	Number of Pregnancies	Operation
70	Large Tumor	Normal	Thickened and oedematous	Premenstrual	Hyperemic	Dermoid Cyst Sacs	2 Years	45	1	Supra-vag Hysterect Bil salp-oophorect
72	Normal	Carcinoma Ampullaris	Normal	Not stated	·	·	1 "	45	4	Dec Radium
73	Multiple Fibroids	·	Very thin	Glands penetr Myoma	Normal	Normal	6 Weeks	39	2	Supra-vag Hysterect Bil salp-oophorect
75	Fibroids	·	Not stated	Not stated	"	Corpus lut eum cyst	3 "	32	0	Myomectomy Appendx Vermiformis enucleat
77	Multiple Large Fibroid	·	Normal	Normal	·	Normal	6 Years	30	Single	Supra vag Hysterect
78	Adenoma Polyposum	Polyp promodes	Hemorrhagic	Cystic	·	Serous Cyst	1½ "	?	·	Bil salp-oophorect
79	Very large Fibroid	Normal	Erythematous submucous	Not stated	·	Both cystic Large cysts	5 "	35	·	: :
80	Sub mucous Fibroids	·	Hemorrhagic no other change	"	·	Normal	2 "	34	0	Supra-vag Hysterect
81	Myoma Uteri	·	Thin premenstrual	Premenstrual	·	·	6 "	31	·	Left salp-oophorect
84	Large Myoma	·	Adenoma polyposum	Not stated	·	Corpus luteum Cyst	8 Months	?	·	Right : "
92	Large Fibroid	·	Thickened Round cell infiltr	Penetrate Muscularis	Salpingitis Isthmica nodosa	Serous Cyst	5 "	41	2	Pan Hystero-double salp-oophorect
93	Large Fibroid	·	Hemorrhagic Area	Not stated	Normal	Normal	3 Years	33	1	Supra vag Hysterect.
95	Large Polyp	Polyp promodes	Not stated	·	"	"	2 "	42	3	Removal of Uterine polyp No bleeding later
96	Fibroids	Normal	Round cell infiltrate hemorrhagic foci	·	"	"	6 Months	52	1	Supra-vag Hystero-Bil salp-oophorect.
97	"	"	Oedematous	Hyperplastic	"	Small lutein Cyst	7 Years	36	Single	Supra vag Hysterect Left salp-oophorect.
98	Sub mucous Myoma	"	Oedematous Hemorrhagic	Not stated	"	Normal	2 ½ years mos	42	1	Bil salp-oophorect.

Summary of the Causes of Uterine Bleeding in Cases of Neoplasms
Seven Causes

	Cases			
1	8	Carcinoma Nos 1-5-8-10-14-24-43-72	21%	Condition of Uterine Adnexa
2	7	Adenoma polyposum of Uterus or Cervix 35-41-44-78-79-84-95	20%	Uterine Tubes	Ovaries
3	11	Endometritis 21-22-46-66-67-68-70-81-92-96-97	30%	Normal 32	Normal 25
4	6	Sub-mucous Fibroids 32-36-62-80-93-98	16%	Diseased 6	Diseased 13
5	3	Penetrating uterine glands 17-20-73 (92 also)	8%	Total 38	Total 38
6	2	Hyperfunction of Ovaries 49-75			
7	1	Degeneration of Neoplasm 77			

In the 38 cases tabulated there were seven different causes encountered for the uterine bleeding, from a pathologic point of view. These seven different causes are as follows:

1. Cause—8 Carcinoma .... 21 per cent
2. Cause—7 Adenoma polyposum of uterus .... 20 per cent
3. Cause—11 Endometritis .... 30 per cent
4. Cause—6 Submucous fibroids .... 16 per cent
5. Cause—3 Penetrating uterine glands .... 8 per cent
6. Cause—2 Ovarian hyperfunction
7. Cause—1 Degeneration of neoplasm and necrosis

From the study of these cases, I find that a polypoid condition of the endometrium appears to be a frequent cause of uterine bleeding. In Group II it was found that the above-mentioned condition was respon-

sible for uterine bleeding in 20 per cent of cases. The same is true of the third group of cases,—here again the condition was encountered by the pathologist in 20 per cent of cases or seven times.

What is this condition of the endometrium that is responsible for uterine bleeding in so large a number of cases? The pathologist calls the condition "adenoma polyposum uteri." It is a soft adenomatous structure of the endometrium containing large numbers of uterine glands and has a tendency to bleed. Ulceration in the form of a break in the surface epithelium occurs frequently on these polypoid structures and the loss of blood is from these areas of ulceration. These polypoid growths also suffer from edema and infection which is shown under the microscope by a round-cell infiltration. When polyps of larger size develop out of an endometrium so affected, the polyps protrude through the cervical canal and another mechanical factor is introduced which may cause uterine bleeding, namely, pressure necrosis of the polyp with cell destruction and escape of blood. Some of these polyps bleed very profusely and dangerous degrees of anemia may develop. Very frequently in necrosis of uterine polyps, an inflammatory reaction occurs in the myometrium and also in the uterine wall, introducing a dangerous factor, which may cause death from sepsis. From a surgical point of view these cases of necrosed polyps with sepsis are very poor surgical risks.

Polypoid condition of the endometrium is a pathologic entity that demands attention as an etiologic factor in uterine bleeding. It is the cause of menstrual disturbance and uterine bleeding in 20 per cent of all cases, whether the underlying factor is infection or neoplasm. I am inclined to believe that an invasion of the endometrium by microorganisms is a factor in the formation of this polypoid condition of the endometrium. It is, however, possible that endocrine disturbance may be an etiological factor. Be this as it may, adenoma polyposum uteri is a frequent cause of uterine bleeding and occurs in at least 20 per cent of all cases.

In 30 per cent of cases of this group of uterine bleeding with neoplasm, the cause of the bleeding must be ascribed to infection of the endometrium. We have here 11 cases in which the pathologist finds an inflammatory reaction in the endometrium and nothing else to account for the uterine bleeding. While these cases all had fibroids of the uterus, the uterine bleeding was due to a pathologic endometrium, the neoplasm playing but a secondary rôle in causing the hemorrhage.

In six cases of this group the specimens showed a submucous fibroid, which was responsible for the uterine bleeding. The specimens show that the uterine mucosa overlying these submucous tumors, undergoes a pathologic change. The mucosa becomes thin, the uterine glands

disappear or become fewer in number. In some cases the mucosa becomes fibrous and edematous and in others a hemorrhagic condition develops in the mucosa overlying the neoplasm. These pathologic conditions developed in 16 per cent of cases. It is a distinct pathologic entity and must be classed as one of the causes of uterine bleeding in fibroids of the uterus. The escape of blood takes place from the diseased mucosa. This pathologic change in the mucosa depends on the neoplasm directly. Whether this pathologic change in the mucosa is due to a pressure necrosis from the tumor or is a distinct disease by itself as a result of the neoplasm, is not known. The fact remains that in about 16 per cent of cases of uterine bleeding, submucous fibroids are found. The mucosa overlying these neoplasms becomes diseased and blood escapes from this damaged mucosa.

Another pathologic condition was encountered in these cases which is of interest. It was found that in three cases the uterine glands penetrated the musculature of the uterus to a very extensive degree. I shall speak of these three cases in detail, because it is important to determine whether this condition of penetrating, profuse and extensive proliferation of uterine glands, can be one of the causes of uterine bleeding in neoplasms of the uterus. From the study of these cases, I believe that extensive proliferation and penetration of uterine glands can readily be the cause of persistent uterine bleeding, because it is a disease of the uterine gland itself.

The history of these cases is as follows:

Case 20.—Patient 42 years of age, never pregnant, was suffering with metrorrhagia for three years. She had a good sized tumor in the uterus. A supravaginal hysterectomy and a bilateral salpingo-oophorectomy were done. When the specimen was examined, it was found that there was an adenomyoma of the uterus. The endometrium had no inflammatory changes. The tubes and ovaries were normal. The only pathologic change found in the specimen was an extensive proliferation of the corpus glands with deep penetration into the muscularis. In this case there is no other way to account for the severe metrorrhagia of three years' standing but to accept this pathologic change in the uterine glands as the cause of the uterine bleeding. In Case 17, the patient was 55 years old and had also a metrorrhagia of three years' standing. The specimen showed an adenomyometritis and penetrating uterine glands with no other abnormalities. In Case 73 we have the same condition. The patient was 39 years old, she had two children. There was a multiple fibroid of the uterus. After operation the specimen showed penetrating uterine glands with no other pathologic changes to account for the bleeding. In Case 92 the pathologist also reports penetrating uterine glands, but in this case, the endometrium also showed round-cell infiltration so it was not included among these cases. This case, however, is an additional proof and further shows that this condition of penetrating uterine glands and extensive proliferation, is a pathologic manifestation of uterine glands and is frequently encountered. It is something that should be taken into consideration, as a cause of uterine bleeding in neoplasm of the uterus.

In one case the pathologist noted that the uterine bleeding was due to degeneration of the tumor itself. It was in Case 77. The patient was a single woman, thirty years old, who was suffering with metrorrhagia for six years. A hysterectomy was done and the specimen showed a degenerated fibroid. The tumor itself was bleeding into the uterine cavity, as a result of cell destruction. While it is not advisable to theorize from one single case, and make deductions, it must be admitted that it is in the domain of great possibilities that a degeneration of a neoplasm occurs and can result in uterine bleeding. Be this as it may in this case here reported, no other deductions could be made. The uterine bleeding was caused by the breaking down of the neoplasm and therefore this condition of degeneration of the fibroid tumor itself is put down as one of the causes of uterine bleeding.

Uterine Bleeding
CHART No V.
DISPLACEMENT, CONGESTION AND LACERATIONS OF UTERUS   13 CASES
Pathologists Report

No	Uterus	Cervix	Endometrium	Uterine Glands	Perineum	Ant. Vag. Wall	Utenne Tubes	Ovaries	Duration of Bleeding	Age	No of Pregn's	Operation	Results
26	Retroverted	Lacerated	Not stated	Not stated	Lacerated	Normal	Normal	Normal	2 Mths	28	2	Trachelorrhaphy Perineorrhaphy Dr. Alexander	Was delivered normally since operation
37	Normal Gilliam operation	Repaired 4 Hrs before	Hyperplasia	Hyperplasia	Repaired 4 M before	"	"	"	4 "	38	Single	D&C Rad 50mg 12 hrs	Excellent result, menses normal after 8 months
55	Retroverted	Lacerated	Not stated	Not stated	Lacerated	Cystocele	"	"	2 Yrs	42	2	D&C Repair Cystocele Shortening R.L.Lig & Uterus Appendectomy	Excellent result
57	"	Lacerated Mds Cell Proliferation	"	"	Normal	Normal	"	"	3 Mths	27	1	D&C Amputation of Cervix Simpson operation	Excellent result
59	Normal	Lacerated	No material obtained by curettage		Lacerated	"	"	"	6 Wks	30	2	D&C Amputation of Cervix Repair of Pelvic floor	Good result
71	"	"	Interval	Interval	"	"	"	"	2 Mths	41	?	D&C Amputation of Cervix Perineorrhaphy	Very good result No bleeding
74	Retroverse	Moderate Laceration	Not stated	Not stated	Moderately Lacerated	"	"	"	9 Wks	26	2	Shortening Round Ligament of Uterus	Good result Pregnancy followed Normal at Term
82	Normal	Lacerated	Premenstrual Hemorrhagic	Premenstrual	Lacerated	"	"	"	2 Mths	36	1	D&C Amputation of Cervix Perineorrhaphy Hemorrhoids	Good result No bleeding
85	Retroversion	"	Not stated	Not stated	Moderately Lacerated	"	"	"	1½ Yrs	22	1	Shortening Round Ligaments Appendectomy	Good result No bleeding
88	"	"	Interval	Interval	Not stated	"	"	"	3 Yrs	20	1	D&C Shortening Rd Ligm'ts Appendectomy	No report
89	"	"	Not stated	Not stated	"	"	"	Cystic	?	28	2	Shortening Round Ligam'ts Left oophorectomy	No report
91	"	Normal	"	"	"	"	"	"	?	25	None	Dr C. Shortening Round Ligam'ts	Good result No bleeding
94	"	Moderate Laceration	Interval	Interval	"	"	"	"	6 Mths	40	3	D&C Shortening Rd Ligm'ts Appendectomy	Partial success Bleeding less

Summary of Causes of Uterine Bleeding in Cases of Displacement and Laceration— 2 Causes

	CASES	
1	9	Vascular Engorgement in Retroversion 26-55-57-74-85-88-89-91-94
2	4	Focal Infection in Lacerations 37-59-71-82

Displacements.—There are 13 cases of uterine bleeding tabulated in Chart V, where the diagnosis was made of displacement of the uterus and lacerations. The cases of uterine bleeding in this group are the most difficult of interpretation as to the cause of the bleeding. Nine cases had retroversion of the uterus and in four the uterus was normally placed. One of these four had an operation for retroversion four months previously. All of the cases had lacerations either of the cervix, anterior vaginal wall or perineum. The condition of the endometrium and uterine glands was not stated in eight cases. In the five cases subjected to pathologic examination, the endometrium and uterine glands were found of the interval type in three cases, hyperplasia in one case and premenstrual in one case. It is very apparent that there was no pathology found in the endometrium and corpus

glands in these cases. In fact the only pathology found in this group
of cases is the displacement of the uterus and laceration, and on this
pathology must depend the uterine bleeding.

A few cases may be of interest in detail. Case 26, the first on the chart, was
a woman of 28 who had two pregnancies. This patient suffered with uterine
bleeding for two months prior to the operation. She has a retroverted uterus
and laceration of the cervix and perineum. She had a plastic operation and an
external Alexander for shortening the round ligaments. No other pathology was
found to account for the uterine bleeding of two months' standing. Case 59
with laceration of cervix and perineum was a woman of thirty years old with
uterine bleeding of 6 weeks' duration. No other pathology to account for the
uterine bleeding. She was curetted and nothing found in the uterine cavity.
A plastic operation relieved her symptoms. Case 94,—retroversion and moderate
laceration of cervix. Patient 40 years old, with uterine bleeding of 6 months'
duration. A curettage showed an interval mucosa,—no other abnormality, ad-
nexae normal. Shortening of the round ligaments brought relief of symptoms.

What is the cause of the uterine bleeding in this group of cases?
Does a retroverted uterus cause uterine bleeding? How are we to ex-
plain uterine bleeding in cases of lacerations? We must explain uterine
bleeding in cases of retroversion on the basis of vascular engorgement.
Emmet called attention to this chronic vascular engorgement in dis-
placements many years ago. The blood supply of the pelvic organs
is peculiar to itself, and the anatomic arrangements are such that
displacement of the uterus disturbs the physiologic balance between
the arterial influx of the blood on one hand and the venous outflow
on the other. There results not only a venous engorgement in the
uterus but the arterial influx is also disturbed. This vascular disturb-
ance must bring about changes in the endometrium which causes uterine
bleeding, though the changes in the endometrium cannot be demon-
strated with the microscope. In the cases of lacerations another factor
is introduced which must have an important bearing on uterine bleed-
ing, namely, focal infection. The cervix with its many glands as a
result of the laceration and influenced by the displacement becomes
a prey to the invasion of microorganisms and a chronic endocervicitis
results. This focal infection brings about changes in the endometrium,
which though undemonstrable, causes the persistent uterine bleeding.
On no other basis can the uterine bleeding be explained in this group
of cases. In Case 57 there was a uterine bleeding of three months'
duration, in a woman 27 years old. The cervix was amputated and
round-cell infiltration found. There were no other abnormal findings.

From the study of these cases we must admit that uterine displace-
ment and lacerations are etiologic factors in uterine bleeding, and that
the uterine bleeding is due to changes in the endometrium which cannot
be demonstrated by the pathologist, due to chronic vascular engorge-
ment and chronic focal infection.

I come now to a class of cases of uterine bleeding, where the cause of the bleeding was put down as ovarian hyperfunction. I shall speak of these cases with a certain amount of diffidence. There were two cases belonging to this class under neoplasm and nine cases in a group by themselves. What is meant by ovarian hyperfunction causing uterine bleeding? The conception is, that as a result of an endocrine disturbance, the ovary functionates beyond a physiologic degree. This hyperfunction of the ovary or corpus luteum keeps the endometrium and uterine glands constantly in a state of hyperplasia and engorgement. In other words the patient keeps on menstruating without a physiologic limit; a physiologic process at first becomes a pathologic one later. In this manner a hyperovarian function becomes an etiologic factor in uterine bleeding.

The history of the two case of hyperovarian function under neoplasm is as follows: Case 1 was a patient thirty-eight years old, with no pregnancies, who was suffering with uterine bleeding for six months. She was operated and a supravaginal hysterectomy and a right salpingo-oophorectomy were done. The pathologist found the endometrium and corpus glands normal except for a hyperplasia. There was a hemorrhagic corpus luteum cyst in the right ovary, the conception being that the diseased ovary was overfunctioning. The second case is identical with the first. The patient was thirty-two years old, no pregnancies, with a metrorrhagia of three weeks' standing. A myomectomy was done and a corpus luteum cyst removed. No other abnormality was found to account for the metrorrhagia. In both of these cases the uterine bleeding was associated with the corpus luteum cyst of the ovary and a possible hyperovarian function.

As said before, I speak of ovarian hyperfunction as a cause of uterine bleeding, with hesitation. An earnest discussion is invited on this subject. Is this a pathologic entity or not? Is it an actual fact that the ovary functionates beyond its physiologic limit or does it only exist in the endocrinologist's imagination? There are very few facts at hand bearing on the ovarian function, upon which argument *pro* and *con* can be based. We do not know in what manner the ovary is influenced by the other ductless glands of the body or *vice versa*. This however we do know, that the product of the pituitary glands affects the uterine tissues most profoundly and we also know that in hypothyroidism with metrorrhagia, the uterine bleeding is promptly controlled by thyroid medication. With these facts before us, it must be admitted that there exists a physiologic endocrine balance, between the ductless glands of the body and a disturbance in this balance may result in an overproduction of hormones in the corpus luteum of the ovary which may keep the endometrium in a state of hyperplasia, resulting in uterine bleeding. Further than this one cannot go into the matter except to state that the therapeutic administration of corpus luteum, ovarian residue, and whole ovary, is at times followed by therapeutic results that are very definite in action.

There are nine cases tabulated in Chart VI where the uterine bleeding was believed to be caused by an overfunction of the ovaries. It will be found by examining Chart VI that in only one, No. 13, of these nine cases was the abdomen opened. In this case a corpus luteum cyst was found enlarged. All the other cases had apparently normal ovaries. However, the ovaries may not be enlarged sufficiently to become palpable in examination and yet manifest a disturbed function. The disturbed function may not rest on a definitely demonstrable change in

Uterine Bleeding
CHART No. VI.
ENDOCRINE DISTRESS   9 CASES
Pathologic Report

No	Endometrium	Uterine Glands	Uterine Tubes	Ovaries	Duration of Bleeding	Age	Number of Pregnancies	Operation	Result
2	Hyperplasia	Hyperplasia	Normal	Normal	6 Months	36	None	Nitox Acid to Endometrium	No Bleeding
13	Premenstrual Endometrium torosa	Premenstrual	"	Corpus Luteum Cyst	- -	30	..	Supravaginal hyst Lev ton sign action to tonas	
28	Normal	Indefinite Type	"	Enlarged?	3 Wks	?	Single	D & C	No further Report
38	Hyperplastic	Cystic Glands	"	Normal	5 Months	41	2	D&C Rad. 50mg 12 hr	Could not be found
52	Premenstrual	Premenstrual	"	"	4 Months of Menopause	49	None	D&C Rad 100mg 24 hr	Private Patient?
60	Hyperplastic	Hyperplastic	"	"	3 Months	48	2	D&C Divulsion & Curettage	No Report
63	Interval Type	Interval Type	"	"	" "	36	2	D&C Divulsion & Curettage	No Bleeding Very good result
64	"	"	"	"	" "	38	3	D&C Divulsion & Curettage	No Bleeding Good result
87	"	"	"	"	9 "	46	Single	D & C	No Report

Summary of Causes of Uterine Bleeding
Hyper-ovarian Function

CONSTITUTIONAL CAUSES
BLOOD DISCRASIE
2 CASES

No			Uterine Bleeding	Operation	Result
16	Chronic Endocarditis	Acute Thyroiditis	2½ Years	Radium 100mg 24hr	Tardy Relief
69	Fibrosis Uteri	Fibrosis of Myometrium	2 years	Hysterectomy	

Records not complete   2 Cases   No 11·34

the ovary itself, but may depend on a disturbance in the physiologic balance between the various ductless glands of the body. In none of the nine cases here tabulated, could one discover any of the other causes of uterine bleeding enumerated before.

Therefore for the want of a better term, and for the want of a better known cause for the bleeding, the cause of uterine bleeding in these nine cases is described as ovarian hyperfunction.

There were two cases of uterine bleeding that were classed under constitutional causes. One was a patient 52 years old with a severe metrorrhagia. She was suffering with an acute endocarditis and an

acute state of hyperthyroidism. There were no local findings to account for the uterine bleeding. Radium brought a tardy relief. The second case tabulated here was one of fibrosis uteri. I have placed this case in this class because the greatest pathologic change is found in the blood vessels. In fact the endometrium was fairly normal. The adnexa were normal. Fibrosis uteri may have an infection as a basis of its etiology, but I could not place the case under infection because it does not conform with the other cases so classified.

The study of the 100 cases of uterine bleeding here reported brings

Uterine Bleeding
Chart VII
Causes of Uterine Bleeding in 100 Cases.
14 Causes.

1 Abortion, all types.

2 Ectopic Gestation

3 Low Implanted Placenta.

4 Chorio-Epithelioma.

5 Inflammatory Reaction in the Endometrium

6 Polypoid Condition of the Endometrium.

7 Carcinoma.

8 Sub-Mucous Fibroids.

9 Penetrating Uterine Glands.

10 Degeneration of Uterine Fibroids.

11 Hyper-ovarian Function.

12 Vascular Engorgement.

13 Focal Infection.

14 Constitutional Causes.

out the fact that there were no less than 14 different causes for the bleeding enumerated as shown in Chart VII.

SUMMARY

1. From the study of the pathologic findings in the 100 cases of uterine bleeding here reported, it is found that the cases may be divided into six classes according to the etiologic factors that are causing the loss of blood from the uterus.

2. That the pathologic changes in the endometrium play the greatest rôle in uterine bleeding and that this occurs in 70 per cent of cases divided as follows: In 34 cases infection plays the important rôle in causing endometrial pathology. In 25 cases neoplasm causes the dis-

turbance in the endometrium and in the remaining 11 cases the endometrium is disturbed by a hyperfunction of the ovaries.

3. That the uterine bleeding is caused also by vascular engorgement of uterus and adnexa and focal infection of the generative organs.

4. That pregnancy including ectopic gestation plays a very important rôle in causing uterine bleeding, having been found present in 13 cases.

5. That constitutional causes play a very minor rôle in causing uterine bleeding.

6. That after incomplete abortion the endometrium undergoes the physiologic change incident to menstruation, although the uterine cavity

Uterine Bleeding
CHART VIII

Conclusions

Uterine bleeding
Classified according to Etiology

1ˢᵗ Pregnancy
2ⁿᵈ Infection
3ʳᵈ Neoplasms
4ᵗʰ Displacement & Lacerations
5ᵗʰ Endocrine Distress
6ᵗʰ Constitutional Causes

Neoplasms 38 Cases
Causes of Bleeding (Seven)

1ˢᵗ Carcinoma	8 Cases
2ⁿᵈ Adenoma polyposum	7
3ʳᵈ Endometritis	11
4ᵗʰ Sub mucous Fibroids	6
5ᵗʰ Penetrating Uterine Glands	3
6ᵗʰ Hyper-function of Ovaries	2
7ᵗʰ Degeneration of Neoplasms	1 Total 38

Infection 23 Cases
Causes of Bleeding (Four)

1ˢᵗ Endometritis	11 Cases
2ⁿᵈ Polypoid Condition of Endometritis	4
3ʳᵈ Various Phases of Menstruation	1
4ᵗʰ Oedema of Endometrium	2
Not stated	5 Total 23

Uterine bleeding in 70% due to
Endometrial Pathology

Infection	34 Cases
Neoplasms	25
Hyper-ovarian Function	11 Total 70

Pregnancy 13 Cases
Causes of Bleeding (Four)

1ˢᵗ Abortion	8 Cases
2ⁿᵈ Ectopic	3
3ʳᵈ Malposition of Placenta	1
4ᵗʰ Chorio-Epithelioma	1 Total 13

Displacements & Lacerations 13 Cases
Causes of Bleeding (Two)

1ˢᵗ Vascular Engorgement	9 Cases
2ⁿᵈ Focal Infection	4 Total 13

Endocrine Distress 9 Cases
Causes of Bleeding (One)
Hyper-ovarian Function

Constitutional Causes 2 Cases
Causes of Bleeding (Two)

Endocarditis & Thyroiditis	1 Case
Fibrosis Uteri	1

may harbor retained secundines which cause continued uterine bleeding as shown in Cases 7 and 36.

7. That in cases of uterine bleeding with history of infection, the bleeding is due to a diseased endometrium, the adnexae remaining perfectly normal. This fact is shown by Cases 3, 30, and 39.

8. That curettage of the uterus is a very important procedure in cases of uterine bleeding, as the bleeding may depend entirely on the condition of the endometrium, in spite of the fact that other pathologic entities may be present, such as diseased adnexa, fibroids, etc. This point was strikingly illustrated in Case 61; the removal of diseased tubes failed to benefit the bleeding, while a curettage brought relief.

9. That in cases of uterine bleeding two or more causes may be operative in the same case at the same time as in Case 29, where there was a

cervical polyp present, a fibroid of the uterus and an incomplete abortion.

10. That adenoma polyposum of the endometrium is responsible for a large number of cases of uterine bleeding, at least 20 per cent, and is a distinct pathologic entity.

11. That when uterine glands penetrate the musculature they may be the cause of uterine bleeding, shown by Cases 17, 20, and 73.

12. That there are a certain number of cases—11 in the 100 cases here reported—of uterine bleeding, where the cause of the bleeding is obscure, where no pathologic changes are found to account for the bleeding, and where we have to fall back upon the theory of endocrin distress. These have been called cases of ovarian hyperfunction.

13. That there are a certain number of cases where the uterine bleeding depends on displacements and lacerations, the bleeding being due to vascular engorgement and ''focal infection.''

14. That submucous fibroids cause uterine bleeding by bringing about changes in the endometrium overlying the neoplasm.

15. That in a very small number of cases, uterine bleeding may be caused by a degeneration of the neoplasm; the necrosis bringing about cell destruction and escape of blood directly into the uterine cavity.

40 East Forty-first Street.

A TECHNIC FOR THE MANAGEMENT OF THE LARGE CYSTOCELE WHEN ASSOCIATED WITH NON-MALIGNANT DISEASE OF THE CERVIX AND MYOMATA UTERI*

By Lilian K. P. Farrar, A.B., M.D., F.A.C.S.

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THE recognition that cystocele is a true hernia of the bladder and that its repair rests upon the same principles governing surgical procedures for the cure of hernia elsewhere in the body, is a development in gynecologic surgery of the past thirty years. Sims (1871) was the first to completely expose the base of the bladder as it is done today, but he did it quite by accident, and did not employ this method again.

The etiology of the occurrence of cystocele and the principles of fascial support of the bladder we owe to Hadra (1888) and to him belongs the credit for first suggesting in 1889 the freeing of the bladder from the cervix and anterior vaginal wall and "resuturing the bladder to the anterior cervical lip as high up as possible." Hadra considered the point on the cervix where the bladder and vagina are firmly attached to one another to be of especial importance—"as a centre upon which the connection and the mutual support of the three organs depend—and the reattachment and restoration of normal relations between the bladder, vagina and cervix is what we ought to look for." Hadra apparently did not perform the operation, for, after giving this technic, he says "I have had no experience in it but I can promise that the following little operation answers our purpose very well," and describes passing a suture through the vaginal tissue on either side of the cystocele and fastening to the cervix, a procedure similar to that employed by Emmet.

The first, however, to appreciate that a prolapse of the bladder is a true hernia seems to have been Munde,[1] who, in 1890, in an article in the *American Journal of Obstetrics,* of which he was then editor, entitled "True Cystocele or Vesicovaginal Hernia," says that "stitches should include separated muscular fibers of the anterior vaginal wall instead of merely drawing together the vaginal mucous membrane." Two years later Skene in "Hernia of the Bladder" gives credit to Munde for this conception of cystocele as a bladder hernia and describes an operation which he had performed on the principle for repair of hernia. The freeing of the bladder was, however, limited "to

the extent of the hernial opening in the muscular layer of the vagina,''
but the lateral edges of the muscular layer of vagina he brought
together with sutures. This, so far as I have been able to find in the
literature, is the first operation undertaken for cystocele with the
knowledge on the part of the operator that he was dealing with a
hernia and the intent to effect a cure by freeing the bladder from the
vaginal wall and then bringing together the separated muscle in the
wall of the hernial sac.

The operation of ''vaginofixation'' associated with the names of
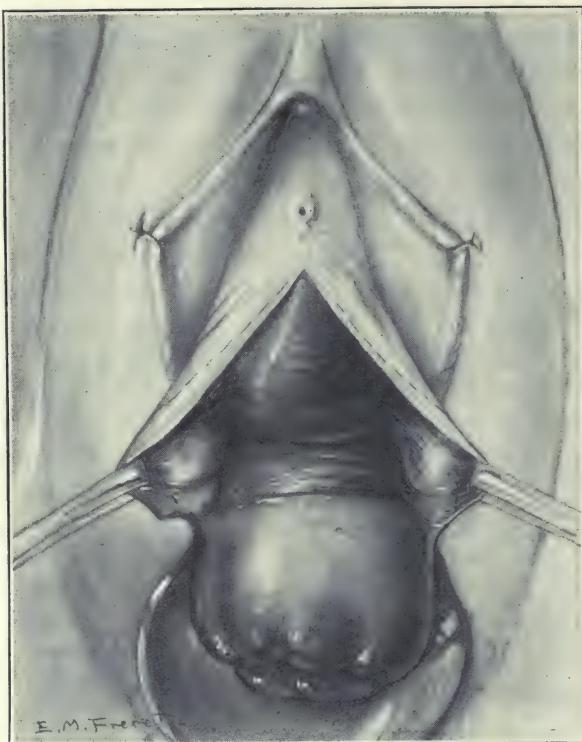
Fig. 1.—Cystocele associated with diseased cervix and myoma of the fundus (with or without procidentia).*

Mackenrodt, Sänger, Dührssen, Schücking and others was the fore-
runner of the interposition operation and the improved operation of
cystopexy. Mackenrodt did the operation first in 1888 by passing a
suture through the cervical canal and fundus of the uterus to the ves-
icouterine attachment and vagina without freeing the bladder. As
the bladder was in danger of being injured by this stitch, Mackenrodt
later made the opening of the vesicouterine peritoneum a preliminary
step to the operation, but never freed the bladder extensively.

*Figs. 1, 2, and 3 are after Ward's technic for cystopexy and amputation of the cervix.
Fig. 4 from Martin's Heftapparat.

The next in order chronologically seems to have been the "flap" splitting method of Sänger." The technic of flap splitting was first applied to the repair of the pelvic floor by Lawson Tait, and by Sänger somewhat later. Sänger applied this technic to the anterior vaginal wall and the operation generally bears his name, but he himself in 1892 gives credit to Gersuny and Arx for being the pioneers in this work. While Sänger approved of bladder separation from the anterior wall of the vagina far out laterally on either side, he disapproved of its separation from the uterus and in this point differed from both Arx

Fig. 2.—Freeing of the bladder and cutting off the thinned-out sac. Amputation of the cervix. Alexandroff's stitch and angulation of the vagina. (Note that the bladder is not attached to the anterior surface of the uterus, but left free.)

and Gersuny who separated the bladder from the uterus but not so high as the peritoneal attachment which they left intact. Arx is the first to mention the elevation (Einstülpung) of the bladder as an important step in the operation but he accomplishes this by turning the bladder mucosa upward into a ridge or cone within the bladder after the method of Emmet. Gersuny and Martin both employed this infolding of the bladder wall which they maintained by interrupted sutures.

The first description of an operation performed after the technic

suggested by Hadra was that given by Stone, of Washington, (1889) who separated the bladder from the uterus and after excising the thinned-out portion of the vaginal wall sutured it to a point on the anterior surface of the uterus on a level with the origin of the round ligament and then opened the abdomen and made "a further separation of the bladder from the uterus and sutured the reflexure to the scarified surface of the uterus near the fundus." If he considered it advisable, he also did a ventral fixation.

It has been of no little interest to me to trace the origin of the transposition operation or as it is known in German literature, the interposition operation. I was a student in Vienna when the discussion was
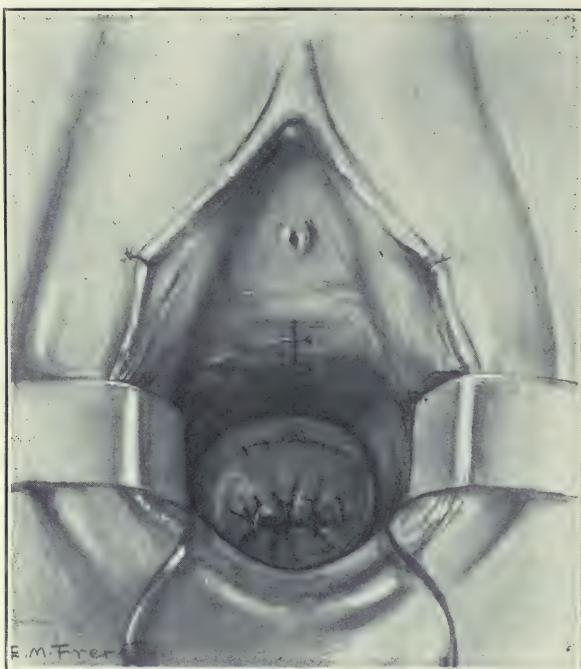
Fig. 3.—Vaginal part of the operation completed.

keenest as to whether the credit for priority belonged to Schauta or Wertheim, and as I was for several months in the clinics of Schauta at the Krankenhaus and also in the clinic of Wertheim at the Kaiserin Elizabeth Bettina Pavilion, I had ample opportunity to hear this discussion from both sides,—but I never heard any credit given to an American surgeon. As the operation is known today in German text books as the Schauta-Wertheim operation, I think it may not be amiss to present the facts in detail.

In 1894 Dührssen reported a series of 250 cases upon whom he had done a "vaginofixation" operation. I mention this because Dührssen

has been credited sometimes as being the first to do the transposition operation, but there is nothing in his report to warrant this assertion. Dührssen did incise the vesical peritoneum frequently to avoid injuring the bladder, but his technic is that of Mackenrodt in vaginal fixation of the fundus of the uterus in cases of retroversion.

In 1896 Freund, when operating for prolapse, made a posterior colpotomy incision and brought the fundus through the opening into the vagina and fastened it to the walls of the vagina. The uterus thus
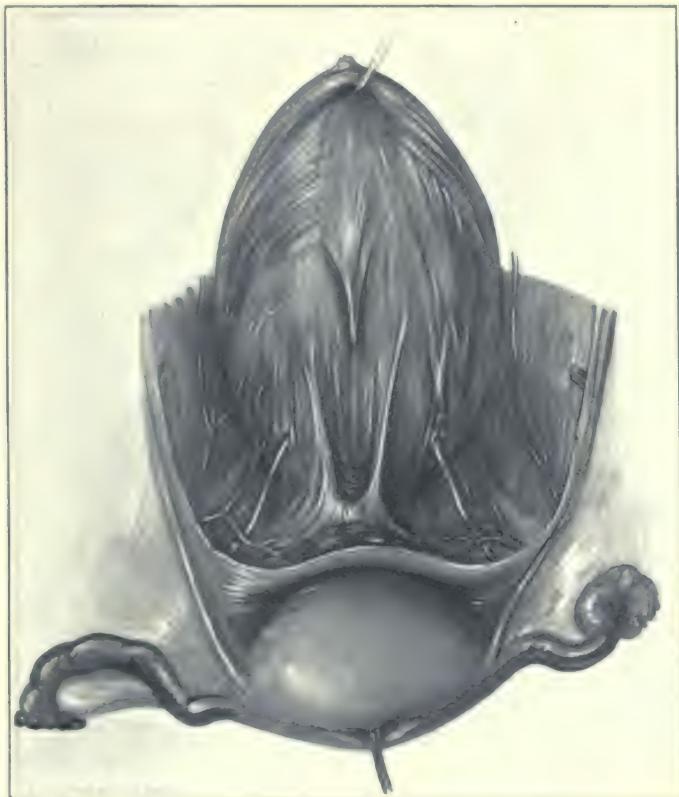
Fig. 4.—The bladder has been completely freed from its vaginal attachments. (Note stitch plicating the tissue and attaching the bladder to the cervix.)

lay in the vagina without any vaginal covering. Freund then made an incision in the fundus for the purpose of drainage.

On January 28, 1898, Thomas J. Watkins, of Chicago, performed a transposition operation precisely as it is done today, bringing the fundus of the uterus below the bladder, fastening it there and suturing the vaginal flaps anterior to the fundus. This operation was reported in the *American Gynecological and Obstetric Journal* for 1899 (xv, 420).

On January 10, 1899 (this is one year later than Dr. Watkin's operation) Wertheim, who said he had in mind Freund's technic, when

operating to cure a large vesicovaginal fistula, brought the uterus into the vagina by an anterior incision and fastened it under the bladder and *anterior to the vaginal flaps,* so that it lay uncovered in the vaginal canal.   On January 18, 1899, Wertheim employed the same technic for a large cystocele associated with prolapse.   This operation Wertheim reported in the *Zentralblatt für Gynäkologie* in April, 1899.

Some time after this Dr. Josef Halban (who was then assistant to Schauta, at that time chief of the Gynecologic and Obstetric clinic) when operating upon a patient according to Wertheim's technic, and at the suggestion of Schauta who was present in the operating room, fastened the vaginal flaps anterior to the fundus of the uterus, as Watkins had done in his first operation.   (This was a personal communication from Dr. Halban to me while I was working in the clinic.) The credit therefore for this operation belongs neither to Schauta nor to Wertheim, but belongs rightfully to Watkins who antedates them both in the transposition of the bladder and the attachment of the vaginal flaps; and the operation should be known as the Watkins' transposition operation.

Löwit in 1909 reported a transperitoneal vaginal supravaginal resection or amputation of the body of the uterus and utilized the cervix, (by sewing it into the vesicovaginal septum), to support the cystocele after the manner of a Watkins operation.

In 1915 Vineberg amputated high up the body of a chronically fibrosed uterus, and, after amputating the lower portion of the cervix, utilized the midcervical portion or stump by suturing it to the subpubic fascia and to the anterior vaginal wall, thus forcing the bladder "to take a position within the abdomen."

In 1902 Alexandroff described the technic, now known by his name, of placing a stitch through the base of the broad ligaments on either side of the cervix drawing them forward and fastening low down on the anterior wall of the cervix, thus making a buttress of them and elevating and forcing the cervix back in the pelvis, a method described later by Tweedy.

In 1901 Reynolds laid down the "principles underlying the repair of cystocele or governing repair of hernia elsewhere," viz.:

1. To ascertain and utilize the natural supports.

2. To avoid using any part of the overstretched wall.   Excision of the thinned-out portion of the anterior wall was done by Noble in this same year, 1901, and Dudley, 1903.

In 1904 Goffe more thoroughly applied the principles employed in repair of hernia and freed the bladder completely from its cervical attachment, overcorrecting the prolapse of this organ by elevating the

bladder base and reattached it high up on the anterior wall of the uterus, and broad ligaments, excising the thinned-out portion of the vaginal sac with the intent to

1. Provide good support for the bladder below.
2. Restore suspensory supports above.
3. Do away with redundant folds of bladder wall at its base.

This spreading out of the trigone of the bladder and its attachment to the face of the uterus and broad ligaments insures, not only a firm supporting surface, but prevents infolding of the bladder wall, as kinking of the ureters with stagnation of urine and consequent irritation of bladder mucosa or cystitis.
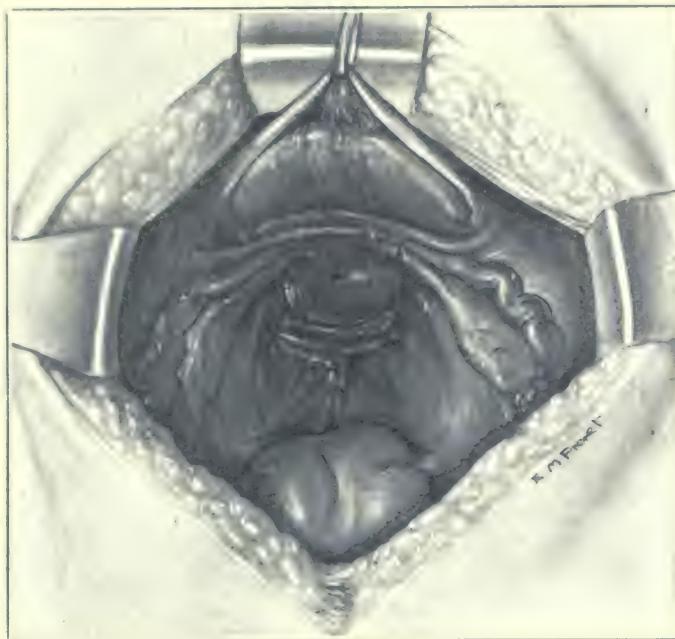
Fig. 5.—Supravaginal hysterectomy has been done and the round ligaments (and the tubes and ovaries if not removed) fastened anteriorly to the stump of the cervix *at the same level* and to the uterosacral ligaments posteriorly to *form a platform* upon which to spread out the bladder.

In 1907 Noble advocated this same technic and by sutures placed in the cervix directly below the bladder gave more firm support the base of the bladder wall, a method reported in 1913 by Lockyer.

Edouard Martin in 1912 in an anatomic study of the genitalia demonstrated the pubocervical ligament (bladder pillars), the importance of which have been confirmed by Frank in 1917 and Rawls in 1918 in their work on cystocele. The reattachment of the vaginal wall together with this ligament restores the invagination of the cervix to normal or to an overcorrection, as in hernial repair elsewhere.

The overlapping of the fascia below the bladder was first reported

by Rawls and Bissell and to the latter and to Mayo should be accredited the operation of uniting the broad ligaments and placing the bladder above after the complete removal of the prolapsed uterus.

The recognition of the supporting and elevating power of the uterosacral ligaments somewhat antedates the above as attention was called to this factor in restoring prolapse or displacement of the uterus by Wertheim and Mandl, Bovée and Noble.

So far mention has only been made of the repair of the cystocele from the vagina, but as early as 1890 the cure of the cystocele was sought by the abdominal method. Byford at this time operated
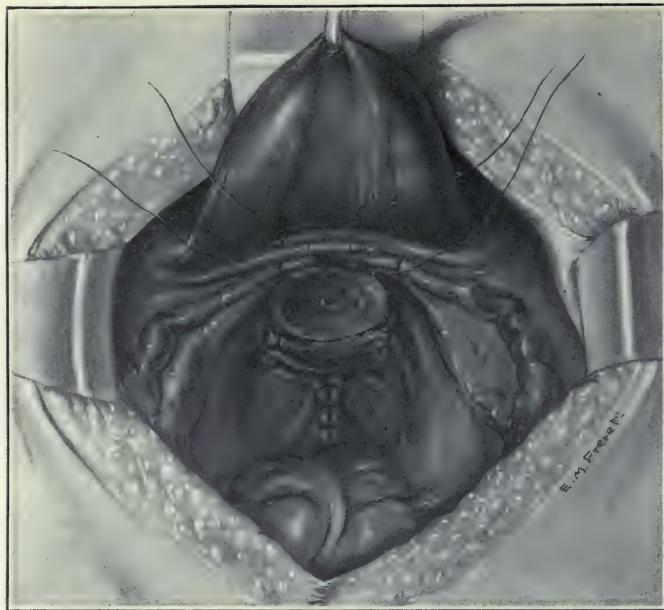
Fig. 6.—Two stitches tack the bladder to the anterior part of the platform.

through the inguinal canals, fastening the tissue on either side of the bladder to the incision.

Lawson in 1898 by suprapubic incision freed the bladder and sutured it to the sheath of the rectus.

In 1903 Dickinson suspended both bladder and uterus to the parietal peritoneum or by actual "fixation of bladder and uterus directly to naked muscle and fascia."

Polk in 1909 presented a technic for restoration from within the abdominal cavity of the prolapse of the uterus when associated with cystocele. The anterior wall of the vagina was plicated from above, and the uterus, if retained in situ, fastened well forward. If supravaginal hysterectomy was done the round and broad ligaments on either side were sutured to the stump of the cervix and the uterosacral

ligaments cut and after crossing them over the stump were sutured to its anterior surface.

In 1919 Ward in the "Problem of the Cystocele" gave a complete résumé of the salient points in the etiology of the occurrence of hernia of the bladder and the technic for its repair, emphasizing the composite nature of the injury and the necessity to correct all the lesions in order that there "should be no weak link."

The technic of the operation I am about to present, so far as it pertains to the vaginal work, follows closely the method laid down by Ward and in the freeing and elevating of the bladder from within the abdominal cavity and the suturing of round and uterosacral ligaments to the stump of the cervix, is very similar to the technic of Polk, although I was not acquainted with the latter's work until I had done four cases.

CASE 1.—Mrs. Q., W. H. 22949. Op. June 27, 1919; one hour and forty-five minutes. Alexandroff; combined vaginal and abdominal cystopexy; rectopexy; hysterectomy, supravaginal (platform); salpingo-ooprorectomy; shortening of uterosacral ligaments; appendectomy.

CASE 2.—Mrs. I., W. H. 23676. Op. October 4, 1919; Alexandroff; combined vaginal and abdominal cystopexy; hysterectomy, supravaginal (platform); shortening of uterosacral ligaments; appendectomy.

CASE 3.—Mrs. C., W. H. 25231; Op. February 20, 1920; 1 hr. 15 min.; Alexandroff; combined vaginal and abdominal cystopexy; op. for incontinence of urine (Kelly); rectopexy; hysterectomy, supravaginal, (platform); salpingo-oophorectomy, (bilateral); shortening of uterosacral ligaments.

CASE 4.—Mrs. R., W. H. 27274; Op. Feb. 11, 1921; 2 hrs. 9 min., amputated cervix; Alexandroff; combined vaginal and abdominal cystopexy; rectopexy; hysterectomy, supravaginal, (platform); shortening of uterosacral; appendix previously removed.

INDICATIONS FOR OPERATION

Occasionally one meets with a case of large cystocele associated with a very much hypertrophied, badly torn cervix necessitating removal, and in the fundus large myomata, the removal of which by the vaginal route would be an impossible or difficult operation attended with great loss of blood and danger of infection. If in addition to this one finds on examination that there is no prolapse associated with the condition, it becomes impossible to reef the broad ligaments below and place the bladder above as in vaginal hysterectomy, or after complete hysterectomy from above to leave the bladder so supported that recurrence of the cystocele is not probable.

The following technic is therefore presented as having been satisfactory in four cases where an enlarged fundus and diseased cervix necessitated their removal, but the large cystocele associated required
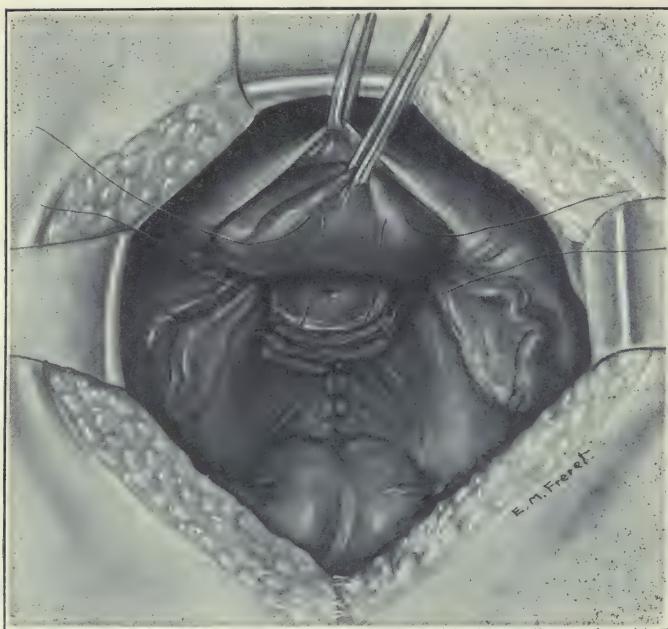
Fig. 7.—Two other stitches complete the attachment of the bladder to the platform **posteriorly.**
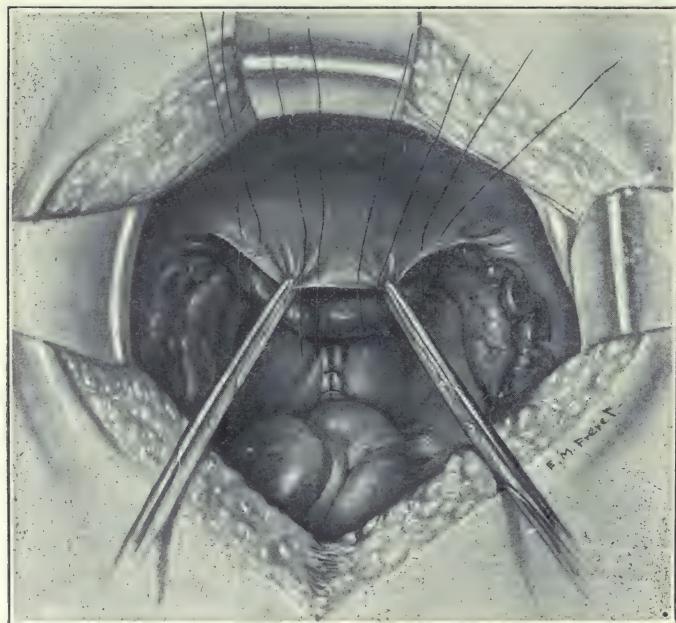

Fig. 8.—The free edge of bladder peritoneum (vesico-uterine fold) is sutured to the **peritoneum**
to more firmly anchor the bladder in position.

a good support for its cure. A repair of the pelvic floor is an essential part of the technic although not shown in the accompanying illustrations.

CONCLUSIONS

1. This technic provides a good support for a cystocele when both fundus and cervix of the uterus must be removed.

2. The firm cervical attachments of the broad ligaments are maintained and the base of the broad ligaments, uterosacral and round ligaments are all utilized to secure pelvic support for the bladder.

3. Bladder is spread out over a platform which prevents any considerable degree of infolding of the bladder wall or kinking of the uterus.

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PUERPERAL MASTITIS

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THE appearance of acute infection in the nursing breast is sufficiently frequent, even in well regulated hospital services, to receive careful attention. The occasional termination of such an infection in mammary abscess is an obstetrical calamity. Therefore, the authors feel that without apology, in spite of a number of excellent recent articles on this subject, further consideration of this infection may not be untimely.

As the title "puerperal mastitis" suggests, we propose in this discussion to devote our attention to those disturbances which occur in the early weeks postpartum. The hospital supervision of maternity patients in many cases ceases, granted a normal puerperium, after two weeks. Therefore many late infections are not seen unless reported back for treatment or detected in the follow-up.

Our present hospital system keeps in touch with the patients until three months postpartum.

Undoubtedly the care of the breasts in the first two weeks has much to do with the avoidance of late infection. From the relatively rare occurrence of breast disturbance in cases where nursing has been well established, it is certain that much of the morbidity from breast infections will be prevented by proper guidance and instruction of the nursing woman.

The importance of this condition cannot be overestimated. A sharp infection of breast parenchyma, even if quickly subsiding, may cause a termination of successful lactation. There is profound nervous disturbance in many of the cases. It is conceded that some of these inflammations may leave an irritation that will be the cause of later malignant growth. A substantial percentage will suppurate, with the sequelae of operative interference, destruction of breast tissue, more or less protracted convalescence, and profound nervous depression. To this is added loss of function for the time and probably in later pregnancies. In hospital or private practice, such an experience causes much dissatisfaction.

As this is a condition due to infection, it is our duty to inform ourselves of the normal incidence of this complication and to strive for the irreducible minimum.

There has been too much vagueness both in definition and in diagnosis of mastitis. Some teachers have failed in definiteness. Where promptness of recognition and treatment weigh so much, this should not be.

An attempt to find the various recorded incidence of mastitis showed wide variations in statistics, from Jewett's statement of five to six per cent, to the statistics collected from varying sources by Norris in the *American Journal of Obstetrics* for July, 1918, in which he quotes a range from one-half to four per cent. Gardiner, in the *American Journal of Obstetrics*, November, (vol. lxxx, No. 5) 19, quotes Webringhaus with 2 per cent, and Fehling, 3.18 per cent.

Our statistics were compiled from a series of 2000 consecutive cases delivered at the Woman's Hospital. There were 57 cases diagnosed as mastitis, an incidence of 2.8 per cent. Our patients are kept in the hospital for fourteen days postpartum. Nine of these cases occurred after the date of customary discharge; three of them were readmissions.

The causes of breast infection may be summed up as germ contamination plus diminished resistance. The old theory of "catching cold" is disappearing from the text-books, but is still difficult to extirpate from the lay mind. The cause of the persistence of this tradition probably lies in the initial chill which is the first symptom recognized.

The presence of the contaminating germ, especially the staphylococcus albus, in the normal maternal ducts has caused much emphasis to be laid on the theory that milk stasis with increased germ activity has permitted bacterial invasion of the tissues. Accordingly, much zeal on the part of nurses in the use of massage or breast pump has in the past been encouraged to avoid such a development.

It is believed that a saner view of the situation is now prevailing. As breasts in which nursing is suspended or not attempted rarely show mastitis, it is more probable that manipulation of distended breasts may diminish the natural resistance of the tissues and increase the liability to infection.

The contamination of nipples by outside organisms is probably the commonest method of infection, especially in those of the severer type. Damage to the nipples from cracks, fissures or erosions undoubtedly favors the entrance of these germs. Infectious contacts may be from fingers of attendants or from fingers of the patient herself, possibly contaminated by handling lochial pads; from the nightdress or breast binder; De Lee, in his text-book, emphasizes the importance of the infant as the source of infection, whether from sprue, pharyngitis, coryza, ophthalmia, or pustular infections,—especially of the face. To this list might be added paronychia.

Our statistics showed 22¾ per cent of infantile complications were recorded in the histories of these mastitis cases, as against 10 per

cent as a general nursery record. Of these, 8 were conjunctivitis cases; 3, pustular; and 2, coryzas.

Some years ago, a private case of the author's suffered repeated mastitis attacks in different parts of both breasts, which disappeared after the healing of some mildly inflamed but discharging forceps injuries on the cheek.

The chance of the nursling transmitting infection from an inflamed to a normal breast by changing the child immediately from the affected side to the other is so great that the nurse and mother must be instructed to avoid such a sequence. Blood-stream infection is probably rarely met with.

The types of infection vary from parenchymatous to primary interstitial. There is a phlegmonous type, usually with severe reaction, and there may be the slowly developing abscess with but slight initial rise of temperature. Another type, exceedingly mild, is that due to infection of the tubercles of Montgomery, the end result of which is the areolar abscess. Rarely the submammary abscess may result.

The early diagnosis of the infected breast is indispensable for successful treatment, as the opportunity for help is greatest in the early stages. There is usually the chill or chilliness, malaise, and headache; the rapid rise of temperature, the localized tenderness of a segment of one breast, and possibly early redness,—especially in the superficial interstitial cases. The infected breasts may show general congestion.

The onset of the infection in our cases showed that from the seventh to the twelfth day was the commonest time of incidence.

In our experience the eighth day is the one peculiarly liable to show a beginning mastitis.

The local pain is not always marked. In confirmation of the diagnosis, palpation to elicit the area of tenderness, may be necessary. On the other hand, nervous symptoms are pronounced. There is often a severe occipital and vertex headache. The rise of temperature is sudden, and may be disproportionately high—from 104° to 106°—considering the local degree of inflammation. These symptoms are explained by the close relationship of the organs of lactation to the central nervous system, and by the ready absorption of toxines from the breast.

The differential diagnosis between this condition and distended breasts ought to be usually simple,—first, because of the time of the onset of the infection, that is, in the second week; second, because of the localization of the process; and last, because of the very slight rise of temperature that is apt to occur with distention. It is true that uncomfortable breasts, in the presence of some sapraemic temperature, may cause a temporary obscurity in the diagnosis. The lay term "caked breasts" is partly responsible for confusion in diagnosis.

There is also the general impression that congested breasts are the forerunner of infection.

Even among the profession we find a careless use of this term. The term "caked breasts," if used at all, should be applied to those hard, congested, or distended; while mastitis should be clearly visualized as a local infection and inflammation due to germs, and with possibilities of suppuration.

Usually the course of the disease tends toward rapid resolution. The fever, from its initial high peak, under proper treatment promptly and progressively declines until at the end of 24 or 48 hours it has reached normal. Some local tenderness may continue for several days. If the fever does not disappear, pus formation is probable. Should the temperature fail to show a steady decline or develop recessions in the initial 24 or 48 hours, either there is pus formation or the infection of another segment of one of the breasts.

The frequency of the occurrence of breast abscesses is variously given by different authorities. Baer and Reis report from the Michael Reese Maternity, .23 per cent occurrence in times, with a rise to 1.74 per cent during the influenza period. Weibringhaus reports .21 per cent; Fehling, .6 per cent; Norris, .45 per cent; our own statistics showed .4 per cent.

The occurrence of suppuration in proportion to mastitis attacks is given by Weibringhaus, 8.33 per cent under Bier treatment to 16 per cent; Fehling, 19.3 per cent; our own statistics, 14 per cent.

The abscess may be of slow formation, and its recognition thereby be delayed for some days after the beginning of infection, and even after the subsidence of fever. If deeply placed, fluctuation is late in appearing, the only symptom being an indurated lump, gradually increasing in size. In slight cases, the formation of pus may be in the larger ducts near the nipple, where, at times, a cure has been effected by the systematic emptying of these ducts.

In approaching the subject of the treatment of mastitis one almost hesitates to advocate his method. The fierce conviction with which various authorities urge treatments of great diversity and give different indications urges Nature's response to be kind under many different handlings. Teachers seem to have varying theories, and in this connection it is interesting to note Baer and Reis' article in the April issue of *Surgery, Gynecology and Obstetrics*, with their careful study of the technic of breast care in 29 different maternities.

They note "the great diversity of opinion is found in those conditions in which prophylactic treatment is most imperative, i.e., the treatment of pathologic nipples, of breast congestions, lymphangeitides, and threatened abscesses," and suggest that possibly a study of the various treatments may serve to unify the kind of treatment in a particular condition.

Is there a possibility of developing a standard treatment for mastitis? Probably not, until someone can bring forward satisfactory statistics in a large number of cases which will carry conviction.

In prophylaxis there cannot be such a wide divergence of opinions. That prenatal care, with advice, especially to the primipara, in regard to cleanliness; and in case of depressed nipples, massage is helpful, no one can doubt. After birth until the milk comes in, very brief nursings—from three to five minutes—with intervals of from four to six hours, is important. Cruel damage to the delicate epithelium is often accomplished before the need for nursing exists. To diminish the acute congestion of the beginning of lactation, the lavish fluid diet so often given by nurses, to hurry up the coming in of the milk, should be forbidden. With the bugbear of distended breasts as a cause for infection cast from our minds, the prophylaxis in mastitis resolves itself into prevention of trauma to breasts and nipples and to the elimination of contact infection as far as possible.

Appreciable lesions of the nipples are not the only cause of infection, for breast abscess occurs not infrequently with the nipple apparently intact; while many cases with severely damaged nipples show no breast inflammatory reaction.

Our technic in the case of damaged nipples is to use a constant dressing of either tincture of benzoin or bismuth and castor oil—drams i to ounces i—or the lead nipple shield. The last is the most valuable of all. With a damaged nipple, all nursing should be through a glass nipple shield. In cases of bleeding, nursing is temporarily discontinued.

In prevention of contact infection, the nipples are, when not in use, covered by a sterile compress or pad of gauze four inches square, held in place by adhesive strips. This does away with the necessity of a binder to protect the nipple, beside providing a sterile dressing which remains in place unless removed by the nurse or doctor. The effect on the patient is educational, establishing a *noli me tangere* attitude toward the nipple.

Further prophylaxis involves the rapid clearing up of all infantile infections, and in case of one-sided mastitis, the prohibition of consecutive nursing from the infected side to the normal one.

In our first 1000 cases, in which the particular protective dressing described above was not employed, the mastitis incidence was 36 cases, with 5 abscesses. In the last 1000 cases, coincident with the adoption of this dressing, the mastitis incidence was 21, with 3 abscesses.

The treatment of the mastitis as soon as diagnosed is a cardinal point in success. The diversity of treatment may be seen from the accompanying table.

Certain therapeutic measures seem to have almost universal accept-

	MASSAGE	PUMPING	NURSING	TIGHT BINDER	CATHARSIS	RESTRICT FLUID	COLD	HEAT
De Lee	no	no	no	yes	yes	yes		
Williams		yes	no	yes				
Jewett	no	no		yes	yes	yes		
Cragin	yes	yes	yes	yes			yes	
Norris	no	no	yes	yes	yes		no	yes
Michael								
Reese Hosp.	yes	yes	no	yes	yes	yes	yes	

ance. These are the use of the cathartics and the employment of a binder for pressure and support. The limitation of fluid in the diet is generally accepted also. An overwhelming majority use ice locally until the presence of suppuration is suspected. The moot points are those which involve the emptying of the breasts by massage, pumping, or nursing.

From the study of Baer and Reis' table, it would seem that the statistics of those continuing nursing were about the same as those who stopped it. The authors feel that the breasts, in the absence of nipple injury, are most safely emptied by the infant, and that the continuation of nursing increases the chance of successful lactation. If, therefore, the attendant believes in the value of depletion at this time, the infant may be the safest agent for accomplishing this purpose. Massage and pumping must be most carefully and gently employed, but may be necessary to supplement the child's nursing.

The failure in the treatment of simple mastitis is evidenced by the proportion of cases in which there is pus formation, and it is by this result that the therapy must stand or fall. Where the physician can show a lower incidence than one-half of one per cent in abscess cases in women who have been followed for a period of three months that treatment should be regarded with respect. Moreover, the ratio of pus cases in proportion to the mastitis cases should be of value.

It is obvious that the mastitis incidence in a hospital where the patients are discharged on the eighth or tenth day postpartum will be insignificant, and statistics based on such short observation valueless.

When the presence of suppuration is suspected, a change from cold to heat gives comfort and hastens localization. All breast manipulation should cease, including nursing. Free incisions with counter drainage by rubber tubes and irrigation with Dakin's solution will hasten recovery.

In conclusion, the authors would urge: (1) more effort toward the prevention of contamination in the first and second weeks of the puerperium. (2) General training of staff and nursing force that the earliest recognition of infected breasts may be achieved. (3) Prompt treatment of the infection by some rational method which will stand the test of figures showing a minimum of suppurative termination.

LEVATOR HERNIA (PUDENDAL HERNIA)

Report of a Case* Operated Upon by Combined Route; Review of
the Twelve Previously Reported Cases

By Herbert C. Chase, M.D., F.A.C.S.

I N consideration of the extreme rarity of this condition, its little
understood anatomic and pathologic features, and the consistent
failure of all operative measures for its cure in the past, I feel that
sufficient interest exists to warrant my early publication of this case,
although only a year has elapsed since operation—too short an in-
terval, of course, to speak of a cure.

DEFINITION AND CLASSIFICATION

Pudendal hernia, as the name implies, is a hernia located in the
pudendum. The term is misleading because other types of herniæ,
inguinal, etc., may also have their termination there. Contrary to
the usual rule, the final resting place of the hernia, instead of its
exit, determines its name, which is further misleading. Von Winckel
has suggested the descriptive term "subpubic hernia." As the essen-
tial anatomical feature is a rent in the levator muscle and its fascia
(and adhering to the rule of naming herniæ in reference to the point
of exit), we believe the term "levator hernia" as suggested by Blake
to be the most appropriate.

Further classifications and subdivisions have been attempted lead-
ing to greater confusion. Some have stated that herniæ, having their
point of exit behind the broad ligament, should be called "perineal
herniæ." This is obviously wrong, because, although piercing the
levator behind the broad ligament, the hernia may, in passing for-
ward under the broad ligament, carry bladder with it as a part of
the sac and still emerge in the labium above the transversus perinei
muscles as in my case. Furthermore, a hernia anterior to the broad
ligament, may break away the transversus perinei muscle at its point
of exit and appear at the perineum, the transversus perinei muscle
being the acknowledged boundary line between pudendal or subpubic
herniæ above and perineal herniæ below. (Patient in dorsal position.)

Where all this confusion exists it would seem timely to suggest a
classification and nomenclature based on the anatomy, which would
give a clear indication of the exact site and structures involved.
Therefore the following classification is suggested, including under
the broad term "levator hernia" all the subclasses, because as stated

above the essential feature—point of exit of all these herniæ—is the levator muscle and fascia.

Levator hernia:

1. Congenital.
   - a. Anterior to broad ligament.
   - b. Posterior to broad ligament.
   - c. Combined (anterior and posterior).

2. Acquired.
   - a. Anterior to the broad ligament.
   - b. Posterior to the broad ligament.
   - c. Combined (anterior and posterior).

HISTORICAL

Pudendal hernia is a condition of extreme rarity; the case which I am about to report being the thirteenth in literature.

It has always been considered incurable and of the thirteen reported cases, attempts at operative relief have been undertaken in only five. Only one has been reported cured (Case 12—Grattan). One case (Moscheowitz—Case 11) had seven major and many minor operations without relief.

To Sir Astley Cooper is usually ascribed priority in reporting cases of this type of hernia. However, he was preceded by Méry, who in 1739 reported in the *Transactions of the Royal Academy of Sciences*, of Paris, the following case:

CASE 1.—Reported by Méry. The hernia was found in a female 5 or 6 months pregnant—age not given. It was somewhat larger than an egg and disappeared on compression. The contents were evidently bladder. The description of this case is not sufficient to differentiate it from ordinary vaginal cystocele. It is, however, included in von Winckel's list of pudendal herniæ.

CASE 2.—Reported by Curade. Cooper was also preceded by Curade, who in 1769, in the *Transactions of the Academy of Surgery* of Paris, reported the following case:—The patient was a female of twenty-six years of age and was 6 months pregnant. On examination a lateral perineal tumor was found which increased in size on standing, or when the patient refrained from urinating for a long time. It was soft and painless. When compressed manually there arose a desire to urinate, and if pressure was continued, urine was actually pressed out. After confinement the hernia disappeared but returned in a subsequent pregnancy.

Curade states that he has no doubt the case was one of pudendal hernia. The description of the physical signs and findings are so accurate, and all point so strongly toward an involvement of the bladder, that I believe there is not the slightest doubt that this case can be placed in the list of true pudendal herniæ.

Nevertheless it is Sir Astley Cooper to whom we are indebted for the first detailed and complete reports of this rare condition. In

his excellent monograph on herniæ, published in London 1807, he reported the two following cases:

CASE 3.—Reported by Cooper. This case was a female, age twenty-two, who had a hernia the size of a pigeon's egg for a long time and which she had always been able to reduce. When Cooper saw the patient, he found a swelling situated below the middle of the left labium, while the upper part of the labium and the inguinal ring were free from any swelling. The tumor extended upward alongside of the vagina nearly as far as the uterine os. The hernia gave an impulse on coughing. Cooper succeeded in reducing the hernia by taxis. In doing so the hernia disappeared upward with a gurgling noise and relief of all symptoms. After reduction of the contents the labium was flaccid, and a finger introduced into this flaccid sac could be passed upward into a circular orifice on the inner side of the ischium, between it and the vagina. Subsequently a "T" binder was used to retain the hernia.

(The above is a verbatim copy of the history from Cooper—in spite of the brevity of the report there is not the slightest doubt that this is a true case of pudendal hernia. It is to be regretted that the anatomy of the hernial ring is not described in detail.)

CASE 4.—Reported by Cooper. This case is merely mentioned in connection with Case 3—the report of same is even shorter. Female, age not given, who had a swelling similar to but smaller than the preceding, and situated in the right labium. It disappeared in the recumbent posture, but reappeared promptly when the patient stood up. Dilated on coughing.

Chronologically the next case reported is that of a contemporary of Cooper—Cloquet—a surgeon who has written extensively on the subject of hernia.

CASE 5.—Reported by Cloquet. Under the title "Sur une hernie vulvaire" this author publishes the following case: Female, age twenty-four, complained of a swelling in the vulva. On examination, Cloquet found in the posterior part of the right labium majus, a round swelling the size of a large chestnut, which stretched the overlying skin and also extended toward the inner surface of the external genital. The swelling was slightly tender and extended upward alongside of the vagina; it became much more tense on standing and coughing and gradually increased in size. The patient noticed the swelling for the first time, only 14 days previously, and she believes that it was caused by straining at her work and at stool. Cloquet was able to reduce the swelling by taxis, the reduction being accompanied by a gurgling sound. After reduction a finger could be invaginated into the labium, whereupon a rounded opening was noticed between the vagina and ramus of the ischium. Nothing further was done but the patient immediately felt relief of her symptoms, nor has the hernia recurred since.

CASE 6.—Reported by Hartmann. This operator reports that he has performed an autopsy upon the body of a female who had suffered for a long time with symptoms of a vesical calculus. At the autopsy there was found a tumor in the labium, which was formed by a portion of the prolapsed bladder. (It is to be regretted that the exact autopsy findings are lacking in this case; on that account it is very difficult to differentiate it with precision from ordinary cystocele.)

CASE 7.—Reported by Hager. This surgeon, under the caption "Vorderer Mittel-fleischbruch bei einem Weibe," describes the following case:—The patient was a

female, age twenty-eight. During her first confinement, which was very difficult, the patient noticed in the middle of her right labium majus, a swelling the size of a walnut. It decreased in size in the recumbent posture, but became larger on standing or walking; it was easily replaced but reappeared promptly. The swelling increased slowly in size during the subsequent four years, and then increased suddenly, became painful and softer. Poultices were applied, whereupon the swelling opened spontaneously at two points, discharged a quantity of blackish fluid and decreased in size. Seven months later in the course of a second pregnancy, the swelling became more annoying, on which account the patient entered Hager's clinic. At the examination, there was found a swelling the size of a pigeon's egg which occupied the right labium majus. The labium majus had disappeared by being stretched over the tumor. The vagina was pushed over to the opposite side by the pedicle of the swelling which passed upward between the vagina and ascending ramus of the ischium. The swelling was very tense and elastic and both painful and tender. Hager diagnosed an anterior perineal hernia (pudendal) which was inflamed and also mildly incarcerated. Under local treatment these symptoms disappeared and finally the patient was discharged just prior to full term delivery.

CASE 8.—Reported by Koenig. Speaking of pelvic herniae, this author says that the most frequent forms are those which descend alongside of the vagina in front of the transversus perinei and then make their appearance upon the surface in the labium majus. He saw one such case which had the size of a man's head—detailed description is not given.

CASE 9.—Reported by von Winckel. In this case the patient was a female who had been confined a number of times; all deliveries were difficult; the last time forceps had been used. Even prior to this last confinement the patient noticed a swelling in the right labium majus. Upon the mesial surface of this swelling another smaller swelling formed, which also increased in size and made quite a projection. On examination a swelling larger than an adult's fist was seen occupying the vulva, and more particularly occupying the part of the right labium majus. It was situated anteriorly and to the right of the perineal body and was bounded externally by the tuberosity of the ischium, and anteriorly by the right half of the symphysis pubis. Even on casual inspection it was seen that the swelling was made up of two different parts; namely, an outer one belonging to the labium and an inner one belonging to the introitus. On careful examination the smaller inner swelling was recognized to be the everted bartholinian gland. In the larger portion, or hernia proper, various structures could be palpated. By manipulation and pressure along the right side of the vagina, most of the hernial contents could be replaced into the pelvis; one smaller body, which was taken to be the ovary, could not be replaced. Treatment with a pessary and a truss was tried first but was absolutely unsuccessful. Von Winckel, therefore, tried a plastic operation *per vaginam*, which was followed by slight improvement, but failed as a cure.

Von Winckel reviewed the published cases of pudendal herniae and reports the following additional one:

CASE 10.—Reported by von Winckel. This patient was a female, age fifty-one, after being in labor for 3 days, and after many attempts of delivery with forceps, she was delivered by perforation. At the age of 46 years, she noticed accidentally, a swelling in the right labium which gave rise to very few symptoms in the beginning, but to many subsequently. The swelling was reducible, and when

reduced, an opening could be palpated underneath the symphysis. Von Winckel made many attempts to treat the patient with a truss, but without avail, and in consequence he decided to operate. The operation was carried out in the following manner:

Through a median laparotomy it was ascertained that the intestines were so adherent to the sac that they could not be liberated; therefore, the proposed closure of the sac from within the abdomen was abandoned and a ventral fixation of the uterus performed as a substitute. For a short while the condition was improved somewhat, but a recurrence followed very soon and the patient was operated upon a second time. At this operation the sac was split up from below, the contents were reduced and the sac obliterated by suture. The patient was greatly improved by this operation but not cured completely. A small hernia still remained which grew only slightly during the next 15 years.

CASE 11.—Reported by Moschcowitz—(verbatim copy of report by Moschcowitz), Mrs. E. L., age forty-one, history prior to 1895 is irrelevant. Delivered by forceps at termination of first pregnancy November 18, 1895. Indication for forceps not evident—pelvis ample size. Shortly after delivery a mass protruded from the vagina and coincidentally with it an incontinence of the bladder was also noted. The condition was first looked upon as one of paralysis of the bladder and a good prognosis was given. The condition, however, did not improve and after being seen by a large number of consultants, she finally came under the care of Dr. F. Lange, formerly of this city, who diagnosed for the first time a "Vaginal Rupture of the Bladder" with complete loss of the urethra and also an ununited fracture of the left pubic bone. Since that time the patient was operated upon a number of times. Only the operations of a major nature are mentioned here. The first major operation was undertaken December 30, 1895, and surprisingly was perhaps the one followed by the greatest amount of success. It consisted of a closure of the defects of the bladder and the formation of a new urethra of the left labium minus. After this operation patient regained control of the bladder.

The second major operation was undertaken May 10, 1896. The previously mentioned vaginal protrusion, which the operator recognized as a hernia, was pushed back and the opening closed by some sort of a vaginal plastic. This operation was not in the least successful; the hernial protrusion recurred immediately, whereupon the patient was informed that before another attempt at its radical cure could be made, it would be absolutely necessary first to repair the fracture of the pubis.

The third major operation was therefore undertaken in January, 1897. The patient was told that the ends of the fractured pubic bone were refreshened and and sutured with silver wire. Unfortunately the wound became infected and had to be reopened. Intractable sinuses formed throughout the length of the incision until the silver sutures were removed about 6 months later; at the same time another unsuccessful attempt was made to cure the hernia by a vaginal operation. This may, therefore, be called the fourth operation.

A fifth unsuccessful attempt at a cure was undertaken in June, 1899.

Thereafter the patient abandoned all hope of a cure for 9 years.

In 1918 the patient again became pregnant and was delivered prematurely by a breech presentation. After this confinement the hernia increased markedly in size; it also became evident, for the first time, that the hernia contained not only the bladder but also intestines. The patient was a total invalid; she became bedridden and suffered a great deal of pain and untold inconvenience from the

hernial protrusion; a particularly annoying symptom was the inability to empty her bladder unless she first reduced the hernia manually.

She therefore readily consented to a sixth attempt at a cure, which was undertaken March 31, 1913, by Dr. Robert Abbe, to whom I am indebted for the following notes: This operation was the first attempt at a cure by the abdominal route. The hernia in the depth of the pelvis was exposed; its contents were found to be the bladder and about 3 feet of small intestines. These as well as the hernial sac were drawn back, and after putting the sac on the stretch to the utmost, the opening was repaired by a sort of cystopexy, the bladder being fixed by six sutures of Pagenstecher linen to the peritoneum and fascia of the anterior abdominal wall. For a while this seemed to fulfill the intended design; however, soon after the patient was permitted to be up and about the condition recurred.

I saw that patient for the first time May 15, 1913. My physical examination revealed the following status: A well healed median abdominal scar. A protrusion in the left labium, about the size of an adult fist was noted; this protrusion was dull on percussion and imparted an impression of translucency; it was reducible, but upon the slightest attempts at reduction the patient felt an uncontrollable desire to urinate. The swelling was so large that its mesial surface, having pulled the vagina down, was covered with mucous membrane. The introitus vaginæ was crescentic, with the convexity toward the right. The left labium minus was absent (result of previous operation). The vestibule of the vagina was so distorted that at first I was entirely unable to find any urethra; finally after a great deal of search I was able to discern an orifice, or better said, the opening of a fistulous tract high up, hidden underneath the symphysis, which on probing led in a tortuous manner upward and to the left into the bladder. Entire vagina was occupied by a protrusion which came down along into left side. When the mass was reduced there was to be felt to the inner side of the descending ramus of the pubis a longitudinal hiatus, easily admitting four fingers. The internal organs were negative to palpation.

The history and physical findings were not very encouraging for a radical cure. The patient, however, was so willing and even insisting that I finally acquiesced to her pleadings and consented to make another attempt in a manner not hitherto tried.

This operation was performed May 27, 1913. Median laparotomy extending from the symphysis pubis to one inch above the umbilicus. Massive adhesions were encountered at the site of the last operation. After liberating the adhesions it was seen that the hernia was of the sliding variety, involving the left half of the bladder. This was very discouraging because at the very outset it prevented me from at least extirpating in a thorough manner the hernial sac as I hoped to do. The small intestines were adherent in the depth of the sac and were freed.

The hernial ring was a large, irregular oval, easily admitting the folded hand, and was bounded externally by the ascending ramus of the pubis, and mesially by the soft tissues of the bladder, uterus, and vagina. The problem of a cure, therefore, resolved itself into the question of my ability to close this opening. Neither pelvic fascia nor levator ani were available. I believe both were ruthlessly torn away at the original forceps delivery. I, therefore, deliberately carried out an operation I had evolved in advance, namely to dislocate the uterus and to use it as a plug for the hernial opening.

In order to enable me to do so, I first extirpated the right ovary and both tubes. After incising the pelvic peritoneum anterior to the left broad ligament, the uterus was dislocated into an extreme sinistro version and fastened in its

new position with a number of Pagenstecher sutures to the descending ramus of the pubis. Had the uterus been only a trifle larger, or the hernial ring only a trifle smaller, it would have been possible to close the hernial ring completely; as it was the lateral portions only could be obliterated, and no matter what I did there still remained a weak area to the right of the dislocated uterus which could not be closed. The best I could do under the circumstances was to pull up the vagina and bladder and suture these organs to the dislocated uterus. The duration of the operation was 2 hours. The convalescence was exceedingly stormy. The patient vomited almost continually for a number of days. Temperature and pulse, however, remained normal. Primary union resulted and the patient was discharged June 19, 1913.

I kept the patient under observation and for some time after the operation she was very comfortable. However, about one year after the operation, I found on examination, that the uterus was again in its normal vertical position—no more sinistroverted and that there was again a hernial bulging. I heard from the patient the last time just one year ago, at which time the hernia had recurred to practically its former dimensions.

CASE 12.—Reported by Grattan. (Verbatim copy as published by Grattan.) Mrs. M. F., age fifty-three, came to me in July, 1918, for relief of the condition which she described as "irritation in the rectum with difficulty in moving the bowels and in addition a bearing down sensation in the vagina," ascribed by two physicians, who had examined her within a year to falling of the womb. The rectal trouble was further described as "a desire to empty the bowels often quite urgent but without result except with the aid of an enema."

The inception for this trouble dated back 4 or 5 years, but remained quite tolerable to within a few months preceding her first visit, when the attacks increased in frequency and severity causing considerable worries and discomfort. She had never noted any blood in the stools. She added that her brother had died recently following an operation for cancer of the rectum. Naturally, I ascribed her concern to the recent family loss but decided to use the proctoscope as a part of the physical examination.

The marital history showed three pregnancies including a difficult twin delivery with loss of one of the twins as a result of a protracted labor. Patient had always done hard physical work about the house through necessity. The condition mentioned as falling of the womb was regarded by the patient as the usual legacy of a hard working mother of several children, but the rectal trouble caused her real concern.

Physical Examination.—General survey—an obese type woman of middle age, height about 5 feet, 4 inches, color slightly cyanotic, facies slightly suggestive of a nephritic condition. Slight dyspnoea on exertion. Thyroid, heart, lungs and extremities show nothing of interest. Abdomen pendulous—no umbilical, femoral, or inguinal hernia. Urine shows faint trace of albumin. Local examination—vaginal examination showed nothing unusual except it be the well-retained vaginal walls without a suggestion of cystocele or rectocele, and a small well-located uterus— all of which argued against prejudice created by the history in favor of a prolapse of the uterus. The cervix was small and normal; vulva normal. Digital examination of the rectum was negative. There was no prolapse; no hæmorrhoids; proctoscopy revealed nothing to account for the symptoms.

I decided to reassure myself by repeating the vaginal examination. With the examining fingers of the right hand in the vagina, I told the patient to hold her breath and strain downward—nothing happened. I asked her to cough several times. All these procedures failed to cause any perceptible descent of the uterus;

but as she repeated the cough I thought I felt an impulse against the back of my examining hand. I had her repeat the cough ten or twelve times. As she did so I observed and felt a definite impulse in the adductor region of the left side. A mass the size of a hen's egg developed at the site of the impulse. The mass was soft, reducible and gurgling occurred on manipulation. The location was crescentic area external to the left labium majus, but not involving that part. The gurgling, the definite impulse on coughing and the reducibility upward of the mass satisfied me that I had found a hernia containing intestine in an unusual location. Patient complained that my manipulations reproduced to some degree the symptoms referable to the rectum, and also gave the sense of bearing down formerly ascribed to falling of the womb. To repeat I knew that she had a hernia but to explain its course of descent was a real problem. In a general way I argued that it must have emerged through some rent in the pelvic floor, occasioned by muscular separation during the difficult twin labor. I hoped that exploration would throw further light on the true anatomy of the condition.

Operation.—Seeing no advantage to approaching from below and feeling that I would lose my landmarks in following the sac from below upward, I chose the abdominal route. A suprapubic incision extending from the symphysis to the umbilicus was necessary on account of the extremely fat abdominal wall. The exposure of the pelvis was difficult because of the great amount of intraabdominal fat and the risk of the exaggerated Trendelenburg position with an adipose subject. Exposure of the pelvic organs finally revealed descent of the sigmoid loop to a triangular opening in the floor of the pelvis. This opening was bounded anteriorly by the posterior reflexion of the left uterosacral ligament; laterally and posteriorly by the rectum. The sigmoid being fixed at its point of continuation into the rectum appeared to slide down along the posterior surface of the broad ligament and disappear through the hernial opening. Practically the entire loop was out of view. Much to my surprise gentle traction brought the entire sigmoid loop out of the sac. There were no surface adhesions and no evidences of constriction at any point. The opening was triangular in outline, with the uterosacral ligament forming the base, the reflexion of the broad ligament the anterior arm and the rectum (in an irregular sense) the posterior arm of the triangle. I inserted my left index and middle finger downward into the sac and had the nurse uncover the inner side of the left thigh, and identify the fingers through the skin covering the sac. There was no process of the sac descending into the left labium as in the cases of pudendal hernia reviewed by Moschcowitz. However, the exit and course of the descent was undoubtedly the same; the final destination being the subcutaneous tissue of the upper adductor region of the thigh rather than the labium.

Gross Surgical Anatomy.—The protrusion undoubtedly occurred through a rent in the levator ani muscle and passed through the triangle, bounded externally by the ischiocavernosus, internally by the constrictor cunni and posteriorly by the transversus perinei, and along the left lateral wall of the vagina emerging in the thigh. The split of the levator was probably the result of the difficult twin labor mentioned in the history. The rectal symptoms were undoubtedly due to the partial kink produced at the rectosigmoid junction when the sigmoid loop descended into the sac. The bearing-down feeling was a natural accompaniment of the hernia. The ready extraction of the sigmoid from the sac at the operation explained the spontaneous reducibility and freedom from symptoms in the intervals.

Closure of the Ring.—Needless to say no attempt was made at extirpation of the sac. Its depth, adipose status of the patient, her age, as an argument against prolonging the anæsthetic needlessly precluded this. With great effort and difficulty I passed five or six mattress sutures of double Pagenstecher linen across the long

arms of the triangle and succeeded in closing it tightly and completely. To make doubly sure I whipped a continuous suture over the line of mattress suture taking another reef in the broad ligament. This last step caused a version of the uterus backward and to the left, superimposing the fundus over the site of the hernial opening. The sigmoid was anchored to the left psoas muscle, the brim of the pelvis and again about 2 inches above that point, the idea being to prevent its descending to its habitual location in the vicinity of the hernial opening. The abdomen was closed by layer sutures. The patient made an uneventful recovery. Mineral oil was used for 6 months following the operation to secure daily evacuation. This is not necessary at present. The sense of prolapse and rectal irritation have never been experienced since the patient left the hospital. Two years have elapsed and repeated examinations failed to show recurrence.

Epicrisis.—While the point of entrance (or internal ring) of the hernia was evidently the same as that of a pudendal hernia there is nothing further to demonstrate the variety. The point of exit was not demonstrated nor was the exact position of the sac. The fact that it apparently did not involve the labium would lead one to believe that the point of exit was behind or posterior to the transversus perinei from whence it dissected up the adductor region of the thigh. In other words there is apparently nothing which definitely distinguishes it from the more common perineal herniæ. A true pudendal hernia must emerge through the subpubic triangle, must involve the posterior part of the labium, and must be covered mesially by vaginal mucosa and externally by integument.

Through the courtesy of Dr. George Gray Ward, Jr., chief surgeon of the Woman's Hospital, in whose service the following case was operated upon by me—I will add to the twelve cases previously reported the thirteenth, as follows:

Mrs. H. A. Woman's Hospital. History No. 26906, admitted December 6, 1920; discharged February 2, 1921. Chief complaints: (1) Pain of bearing-down character in lower right quadrant of abdomen; (2) bearing-down feeling in the right labium and vagina; (3) sense of pressure and bearing-down feeling in rectum and in bladder when coughing, straining, etc.; (4) a feeling as if everything is dropping out and has to hold hand over right side of perineum when straining at stool, during urination, etc.

The family history is negative. Patient has had no illnesses, except diseases of childhood. Menstruation began at 15, always regular, 28-day type, lasting 3 days, moderate flow, no pain. Married 16 years, six children, three miscarriages, all spontaneous at about third or fourth month. Oldest child 14 years, youngest 17 months. All normal deliveries except the last which was a forceps delivery and patient was in labor 28 hours.

Present Symptoms.—Twenty-one months ago, when patient was 4 months pregnant, while working in a mill, felt sudden sharp pain in lower right quadrant, and in vagina and rectum, with bearing-down sensation, as if wanted to move bowels and could not. Pain became severe in half an hour and she was taken home, given some pills and a hypodermic and put to bed. Vomited the medicine and continued to vomit daily for a week, with continuous pain, slight fever, bearing-down sensation and could not get bowels to move. Markedly distended for a week. Given enemata and cathartics daily and finally bowels moved on the seventh day. At the onset of the pain the bulging of the vagina was noticed for the first time, and has remained since but seemed larger during the attack. Throughout the remaining 5 months of her pregnancy, the bulging was a constant annoyance and had to be

held with the hand when straining at stool, urinating, etc. When labor started in at term the bulging became larger, and after the membranes ruptured, and the head came downward with each contraction, the lump got bigger and pain more intense; and then receded with the abeyance of each pain. Also vomiting was constant throughout the labor. The doctor came and tried to push the mass above the baby's head, but could not and gave her chloroform after summoning another doctor to help, and used forceps. This took 2 hours. The child was normal, weighing 8¼ pounds. Patient was in bed for two weeks.

After delivery no vomiting or fever occurred, but the rupture got bigger and had to be held with the hand on straining, and bowel movements and urination were very painful. Since then the bulge has gradually gotten bigger requiring holding with each defecation and urination.

Physical Examination.—A general survey shows a rather obese, well-developed young woman of good color. Height 5 feet, 5½ inches; weight, 170 pounds. Heart and lungs normal; abdomen obese and pendulous, otherwise negative. No umbilical, inguinal, or femoral herniæ.

Local Examination.—A protrusion was seen in the posterior part of the right labium, the size of an adult fist. It was semi-resonant to percussion, easily reducible, with an impulse on coughing. On attempts at reduction the patient felt a sense of pressure high in the rectum and a desire to urinate. When the mass bulged on coughing or straining, its mesial surface was covered with mucous membrane of the vagina, and its external or right surface with integument, and the mass occupied the posterior half of the right labium. The vagina was crescentic with convexity toward the left. On straining the entire vagina was occupied by a soft mass which came downward on the right side parallel with the vagina. When the mass was reduced the labium was left flaccid and redundant, and passing the fingers upward and inward through the flaccid labium, along the right lateral wall of the vagina, an irregular, ovoidal hiatus, could be felt on the right side of the vagina, bounded mesially by vagina and externally by the descending ramus of the ischium. This opening admitted four fingers which could be easily passed through it, palpating the pelvic organs on the right side. A curved sound passed into the bladder showed no cystocele, but the sound passed outward and downward could be brought through the hiatus and felt in the bulging sac. With the hernia reduced, proctoscopy was negative as was also digital examination of the rectum. With the finger of one hand in the rectum and the finger of the other hand in the vagina, the mass could be felt on straining to come down the right lateral wall of the vagina between the two examining fingers. The pelvic organs were otherwise negative except uterine pregnancy at third month, moderate laceration of perineum and bilateral laceration of cervix. No rectocele or cystocele.

Operation.—The diagnosis of pudendal hernia having been made, it was determined after consultation, that a therapeutic abortion should be done because of the strangulation of the hernia during the last labor, the fact that the patient had six living children, and further because we felt that this serious type of hernia, hitherto always regarded as incurable, should not be operated upon so close to the expected labor. Accordingly it was planned that the operation be undertaken in two stages: first, the therapeutic abortion and the operation by the abdominal route for reduction of the contents and closure of the ring; second, operation by the vaginal route for removal of the sac and plastic repair of the levator, fasciæ, etc.

Stage I, Abdominal Route.—Dilatation and curettage; salpingectomy, bilateral (sterilization); closure of hernial ring; sigmoidopexy.

Findings and Operation.—Examination under ether shows, when the patient is straining, a mass the size of a man's fist, bulging into the vagina on the right

side, occupying the posterior part of the right labium. After curettage was performed and the usual products of conception of the third month removed, the uterus was packed with iodine gauze. The abdomen was then opened by a median suprapubic incision 5 inches long. The pelvic loop of the sigmoid was found to be very mobile, with mesosigmoid 7 or 8 inches long, the entire sigmoid loop being in the pelvis and the only fixed point being the rectosigmoidal junction at the end of the mesentery. The sigmoid loop, by sliding with its mesentery and the upper portion of the rectum, had pushed forward and slightly to the right, behind and underneath the right broad ligament, at the junction of the right broad ligament and the cervix, just external to the junction of cervix and right sacrouterine ligament. At this point, where there is normally a slight fossa, bounded mesially and internally by the right sacrouterine ligament and anteriorly by the base of the right broad ligament, and externally to complete an imaginary triangle by a line drawn between these two points, the knuckle of bowel had, after partially tearing away the anterior end of the right sacrouterine ligament, pushed forward and downward, tearing a hole in the rectovesical fascia, which would easily admit three fingers. The loop of bowel having been lifted from this canal, two fingers were passed forward through the opening, under the right broad ligament forward and downward, when it was ascertained that the bladder (inferior and right lateral surface) remained in the canal. The bladder was then drawn up out of the sac and my assistant, passing two fingers through the vagina into the hiatus, brought his fingers into contact with my fingers above. I then had him attempt to turn the sac into the abdomen by pushing upward from below. The sac was adherent and this could not be done and after a few attempts this was abandoned, for we soon realized that the opening in the rectovesical fascia, above and behind the broad ligament, and the opening in the levator below and in front of the broad ligament, were so far removed (about 2 inches) from each other, that it would be impossible, without extensive dissection in a very vascular area, and complete mobilization of uterus and right broad ligament, to close the muscular hiatus as well as the fascial opening from above. In other words, we realized that we were dealing with a combined (anterior and posterior) variety of hernia and a combined operation would be necessary. We realized further that even if we were to close both of these openings from above, the opening in the pelvic (ischiorectal) fascia below would remain and the sac although cut off would remain. The fact that we were dealing with pregnancy and its accompanying vascularity was further argument against this extensive dissection. Therefore, we decided to content ourselves simply with closure of the ring, leaving the rest to be completed at the second stage through the vaginal route. The bowel was drawn out of the sac and held taut and the peritoneal margins of the ring were completely circumcised. This exposed to view the raw edges of the rectovesical fascia. This fascial opening was then closed with eight interrupted sutures of fine Pagenstecher thread. Above this a second layer was placed using six double fine Pagenstecher interrupted sutures for closure of the peritoneal edges covering over the first layer. To form an additional barrier the broad ligament, at the lower edge of its base, was brought over against the sacro-uterine ligament, thus joining the two arms of the triangle with five interrupted Pagenstecher sutures obliterating the fossa. Just mesially to this last line of sutures the rectosigmoidal junction was attached to this column by a single Pagenstecher stitch to prevent knuckling of the bowel at this point. The pelvic loop of the sigmoid was then drawn out of the pelvis and fixed by four sutures to the anterior surface of the psoas muscle and the peritoneum covering this muscle with four sutures of Pagenstecher thread (sigmoidopexy). Sterilization was then performed by removal of both tubes well into the cornua

in the usual manner and closing the cornua with Pagenstecher thread. The abdomen was then closed in the usual manner—using three stay sutures of silk (B. & B.) and black silk for the skin. Convalescence was uneventful and afebrile. The abdominal incision healed by primary union. Her general condition remained good. On the twenty-third day, the patient not having been out of bed, the second stage of the operation was undertaken as follows:

Stage 2, Plastic Repair.—A curvilinear incision 3½ inches long was made beginning at the mucocutaneous junction high up within the right labial fold opposite the opening of the duct of Bartholin's gland, extending downward and across the perineum at the mucocutaneous junction to the same point on the opposite side. The mucous membrane, superficial fascia, and skin were dissected up, including the anterior layer of the triangular ligament, thus exposing the triangle (subpubic triangle) bounded internally by the constrictor cunni, externally by the ischiocavernosus muscle, and below by the right transversus perinei muscle. The hernial sac was seen to bulge through this triangle and through an opening in the split levator and ischiorectal fascia which would admit three fingers. The sac was pear-shaped, now being empty, and about the size of a large pear. The right levator had been split by the protruding mass so that a band about 1 inch wide of levator fibers was internal to the sac and the remainder of the levator external to it. The inner band of levator fibers was separated from the sac which was adherent to it and this band pushed outward. The adhesions of the sac to the split edge of the levator explained why it had been impossible to invert the sac into the abdomen during the abdominal operation. The sac was then freed up to its neck and split open. The sac was empty, lined with peritoneum on its internal surface, and a finger passed into the sac up to its neck felt the sutures firmly uniting the pelvic fascia above (these sutures having been placed during the abdominal operation). The split sac was transfixed at its neck with a suture of kangaroo tendon tied off and excised high. The stump was then carried outward to the right and behind the broadest portion of the right levator muscle and the sutures transfixing this were brought through the levator and sutured through and through also catching the reflexion of the fascia at the white line, thus fixing the neck of the sac against the posterior surface of the broad base of the levator. The torn levator was then repaired by suturing the two bundles together with three interrupted sutures of kangaroo tendon. The opposite levator was then dissected out and an ordinary levator myorrhaphy performed using five kangaroo sutures, suturing the muscle together in the median line. The torn and attenuated ischiorectal fascia was then repaired by suturing with interrupted stitches of fine kangaroo tendon. The mucous membrane was then closed in the usual manner with interrupted stitches of fine chromic gut, with excision of the redundant mucosa and a subcutaneous stitch closing the skin.

Following the second stage of the operation patient made a speedy and uneventful convalescence. She was allowed out of bed on the eighteenth day and discharged from the hospital on February 2, 1921 (fifty-second day). The discharge note reads as follows: Abdominal incision—primary union. Vaginal incision and perineorrhaphy—solid primary union. No protrusion or bulging—relieved of all symptoms.

The patient has remained perfectly well and free from all symptoms up to the present time, although through necessity she has worked hard. During the year she has had six follow-up examinations by myself and other members of the staff, all of which had failed to show any sign of recurrence. The only postoperative treatment has been a nightly dose of liquid petrolatum. The last follow-up examination, November 30, 1921, is as follows: Abdominal incision well healed and

solid. Vaginal incision well healed and solid. No bulging or protrusion on cough-
ing or straining; no sign of recurrence. Uterus in normal position, adnexa negative.
(Examined by Dr. Ward, Dr. Farrar, and Dr. Chase.)

<center>SURGICAL ANATOMY</center>

So many intricate and interesting problems are presented in the mech-
anism and anatomy of this type of hernia that it would seem appro-
priate to describe more fully here the surgical anatomy of this condition.

1. *Point of Entrance (or Internal Ring).*—This may be anterior or
posterior to the broad ligament, giving rise to three varieties: first,
anterior or direct; second, posterior or indirect; or third, a sac origi-
nating behind the broad ligament may push forward under the broad
ligament and break through the levator anteriorly, thus combining
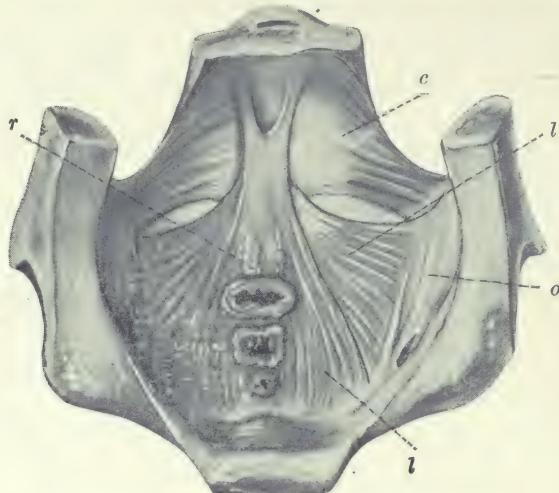
Fig. 1.—Showing the weak points in the pelvic diaphragm above—the beginning of levator
herniae internally. *r,* Rectococcygeus; *c,* coccygeus; *l,* levator ani, and *o,* oblique fascia.

features and contents of both anterior and posterior types. To this we
have given the name "combined type."

The point of entrance of the posterior variety or its beginning is
at the weak point in the pelvic diaphragm internally. From a con-
sideration of the anatomy and formation of the various layers of the
pelvic diaphragm and from a study of dissections and by a reference
to Fig. 1, it will be seen that this weak point is at the three posterior
divisions of the levator muscle. It is obvious at once that the lateral
portions of the levator (m. iliococcygeus) does not overlap the central
portion (m. pubococcygeus) laterally, but passes onward to fuse di-
rectly with the pubococcygeal and rectococcygeal raphé. This leaves
a space on each side behind the broad ligament where there is no
muscular covering and where the pelvic or rectovesical fascia is sep-
arated only by areolar tissue from the ischiorectal fascia, the two

fascial planes being in contact, obviously a weak point. No such condition exists anterior to the broad ligament where the lateral (m. iliococcygeus) portions entirely overlap and fuse with the pubococcygeal portion of this muscle. This no doubt explains the predominance of the posterior variety (8 out of 11 cases reported) and further the fact that only the traumatic varieties are anterior (direct trauma). The internal boundaries of the posterior variety (i.e., of the ring) are then, the broad ligament anteriorly, the sacrouterine ligament mesially, and an imaginary line between two areas of the
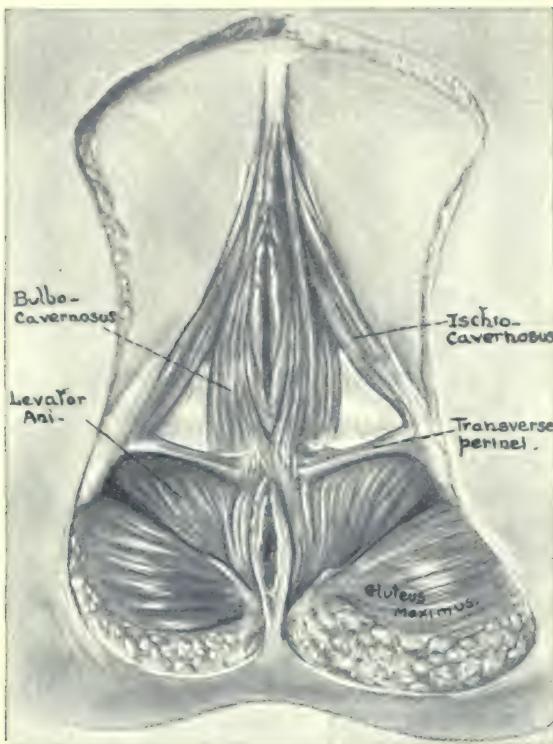
Fig. 2.—Showing the "subpubic" triangle and its boundaries through which all true levator herniae must emerge.

triangle. The rectum forms (irregularly) part of the mesial boundary posteriorly. The boundaries of the anterior variety at the point of entrance are the uterus and bladder mesially, the round ligament externally, and below the vagina and the transversus perinei muscles, while the base is formed by the lineæ terminæ of the pelvis. The significance of the transversus perinei muscle as a boundary for differentiation between pudendal and perineal herniæ has already been pointed out in the classification.

Sac and Contents.—The sac is obviously longer and more definitely defined in the posterior variety (i.e., in herniæ originating posterior

to the broad ligament). This is of practical importance because the surgical principles of high ligation of the sac and closure of ring are applicable always to this variety. This I wish to emphasize because, although pudendal hernia has been regarded as a hopeless surgical
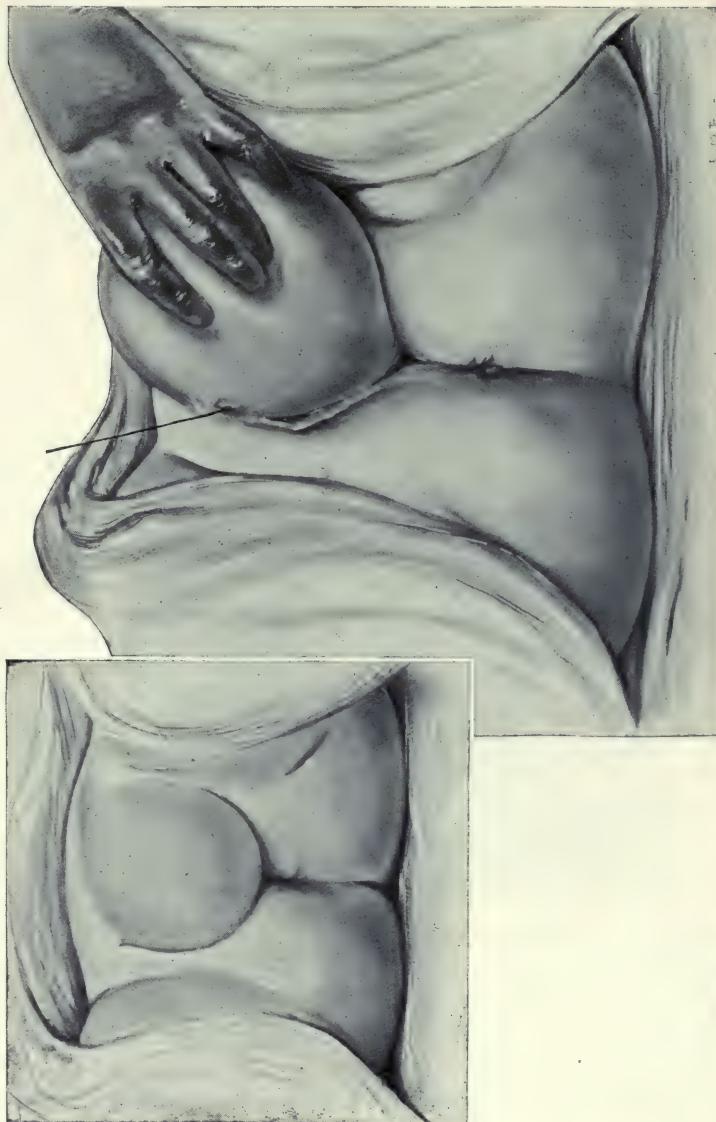
Fig. 3.—Showing Case II (Moschcowitz). Published through courtesy of Dr. A. V. Moschcowitz and Dr. George Gray Ward, Jr.

problem, the posterior variety at least is always amenable to surgical repair and to the application of the two principles mentioned above. Careful examination will determine whether a given case of pudendal hernia is of the anterior, posterior, or combined variety. In the first place with the hernia reduced, the point of entrance internally may

be felt and its position relative to the broad ligament and uterus de-
cided upon. Further, the contents of the posterior variety is usually
gut alone with bladder or with ovary and tube, and the "combined"
can easily be recognized by the fact that it contains both bowel and
bladder. It may contain ovary and tube also, but always bowel and
bladder, both of which can be recognized by symptoms and examina-
tion. The anterior variety always contains bladder. The practical
bearing of recognizing the contents of the sac and type of sac (an-
terior, posterior, or combined) will be at once apparent in the de-

Fig. 4.—Showing the "levator hernia" before operation. Note position of sac (through sub-
pubic triangle) and that its internal surface is covered with mucous membrane and external
surface with integument.

scription of the operation and pictures of same. In producing the
three types of this hernia artificially in the three cadaver dissections,
this classification as a practical basis for surgical repair became at
once apparent. The posterior and combined varieties, containing
bowel, are always of the sliding type.

In the anterior variety we find a more difficult and different situa-
tion. The sac is less defined and only partial because the bladder
which forms the contents of the sac, is only partially covered by

peritoneum—laterally and inferiorly—so that the hernia is necessarily of the paraperitoneal variety. The sac is therefore, incomplete and its removal and closure fraught with far greater difficulties (Case II—Moschcowitz exemplifies this).

Canal and Course.—The posterior variety passes downward and forward perforating the rectovesical fascia, then the ischiorectal fascia to its ring and exit to be presently described. It may pass through the levator or through the weak fossa above described, and pass forward guided by the ischiorectal fascia. The posterior variety may also burrow forward and downward under the broad ligament, per-
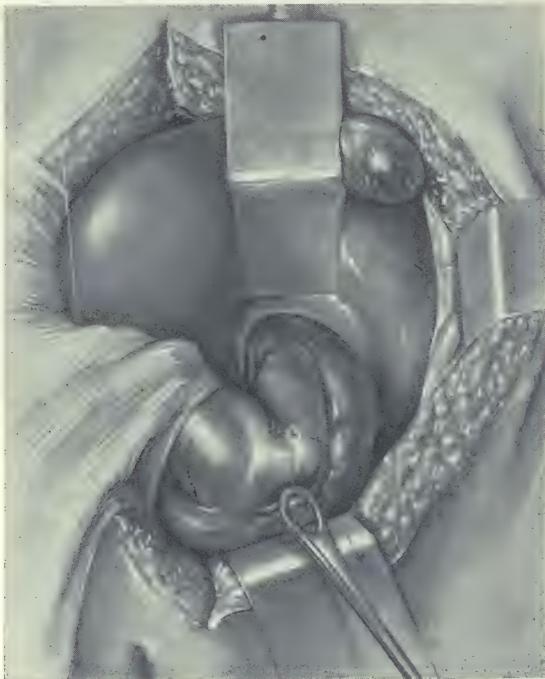
Fig. 5.—Abdominal route. Showing the pregnant uterus displaced to left and loop of sigmoid piercing right broad ligament. Dotted lines indicate knuckle of bowel pulled up from sac; median incision seen from above and behind uterus.

forating only the rectovesical fascia and become anterior to the broad ligament before perforating the levator, thus constituting the combined variety (containing both bowel and bladder). In the anterior variety, the course and canal with incomplete sac is obviously much shorter, passing directly downward and forward to the ring and point of exit.

External Ring or Point of Exit.—This is an irregular triangular area bounded externally by the ascending ring of the ischium and a part of the descending ring of the pubis, mesially by the vagina, and posteriorly by the transversus perinei. It is this ring that can be
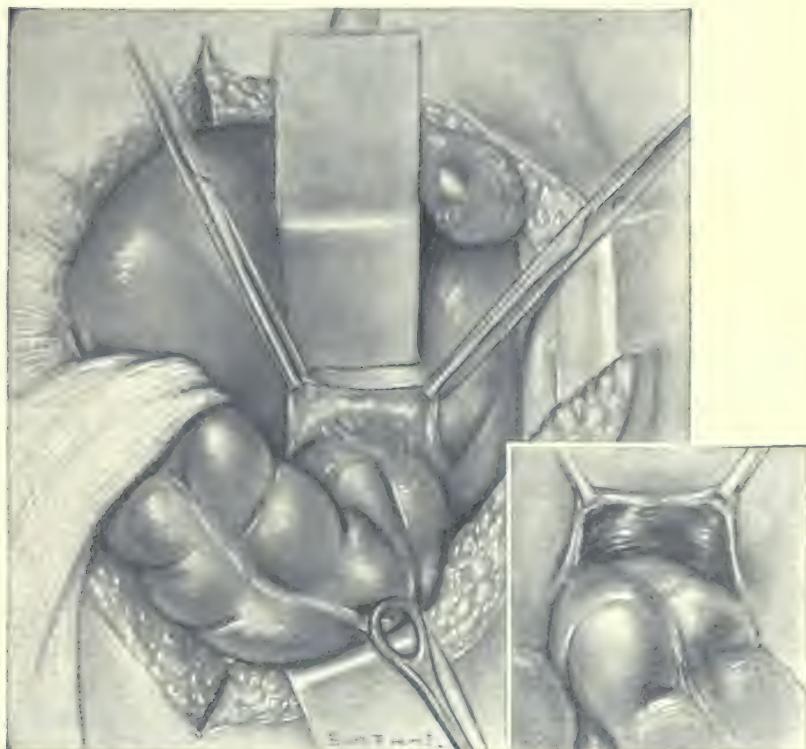
Fig. 2.—Abdominal route. Showing the sac pulled up partly after reduction of loop by traction. Insert shews peritoneal edges of sac held up with fascia showing below after circumcision of margins as indicated by dotted line in large picture.

TABLE I.—ETIOLOGY

CASE NO.	AUTHOR	TRAU- MATIC	SPONTA- NEOUS	AGE	SEX	SIDE	CONTENTS	OPERATION AND RESULT
1	Méry	Yes	No	Not given	F	Not given	Bladder	None
*2	Curade	Yes	No	25	F	Not given	Bladder	None
*3	Cooper	Yes	No	22	F	Not given	Intestines	None
*4	Cooper	Yes	No	Not given	F	Right	Intestines	None
*5	Cloquet	Yes	No	24	F	Right	Intestines	None
6	Hart- mann	Yes	No	Not given	F	Not given	Bladder	None
*7	Hager	Yes	No	28	F	Right	Not given	None
*8	Koenig	Yes	No	Not given	F	Not given	Not given	None
*9	Von Winckel	Yes	No	Not given	F	Right	Intestines	Failed
*10	Von Winckel	Yes	No	51	F	Right	Intestines	Failed
*11	Mosch- cowitz	Yes	No	44	F	Left	Intestines	7 ops. failed
12	Grattan	Yes	No	53	F	Left	Intestines	Cured 2 years
*13	Chase	Yes	No	34	F	Right	Intestines	Cured 1 year

Cases marked with * are proven cases of pudendal subpubic hernia.

easily palpated and digitally explored in these cases.   The trans-
versus perinei muscle forms the posterior boundary of the weak tri-
angle of exit, which is covered only by two layers of the triangular
ligament (thin fascial layers).   The other boundaries of this triangle,
through which the hernia passes after coming through the ring (these
muscles also forming part of ring borders) are the constrictor cunni
internally and the m. ischiocavernosus externally.

Having traced the entrance, course, and exit of the various types,
let us follow the sac reversely; that is, from without inward in the
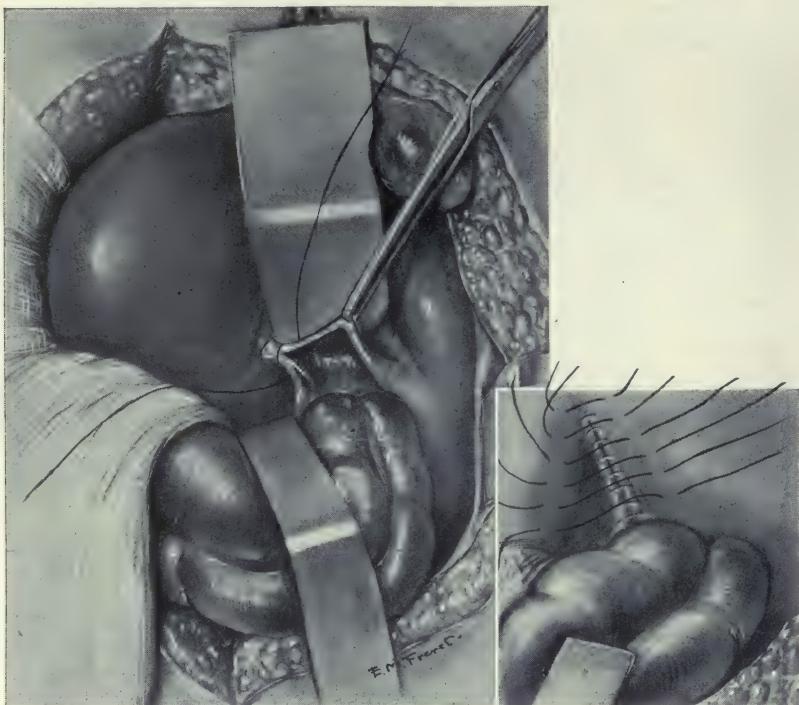
Fig. 7.—Abdominal route.   Showing the fascial closure (rectovesical—true pelvic fascia)
beneath peritoneum.   Peritoneal edges not well shown above fascial split.   Insert shows
second row of sutures of peritoneum, unfolding the fascial layer.

combined type as described in case here reported and note the struc-
tures through which it passes.   Covering the knuckle of bowel and
bladder, from without inward, we have the skin and mucosa and
peritoneum only.   The structures penetrated from without inward
are, the anterior layer of the triangular ligament, posterior layer
of the triangular ligament, ischiorectal fascia, levator and rectovesi-
cal fascia.   In the direct or anterior variety the structures pene-
trated by the sac and the coverings of the sac are the same as in the
posterior variety, except that peritoneum only partly forms the sac
and the hernia is of the paraperitoneal type.   A clear understanding

Fig. 8.—Abdominal route. Showing final steps of closure of internal ring or entrance of levator hernia internally. To close triangle base of right broad ligament is brought over to cervix and right sacrouterine ligament. Intestine fixed by rectopexy stitch to avoid "sliding."
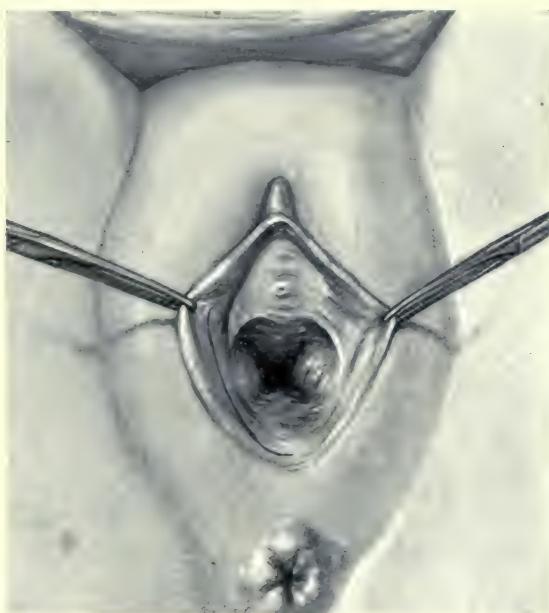
Fig. 9.—Vaginal route. Showing the condition several weeks after completion of the abdominal operation. No evidence of hernia, normal parous vagina, primary incision.

of these anatomical relations is necessary for a successful repair of this type of hernia.

Mechanism of Occurrence.—The long pelvic loop of the sigmoid fixed only at its junction with the fixed rectal portion of the gut at the end of the mesentery (opposite the third sacral vertebra) "knuckles" at this fixed point after slipping down along the posterior surface of the broad ligament. At the site of this kinking (rectosigmoidal junction) is the weak spot of the pelvic diaphragm above (Fig. 1). In this angulated position the gut "slides" *en masse* forward and downward pouching the peritoneum ahead of it, tearing
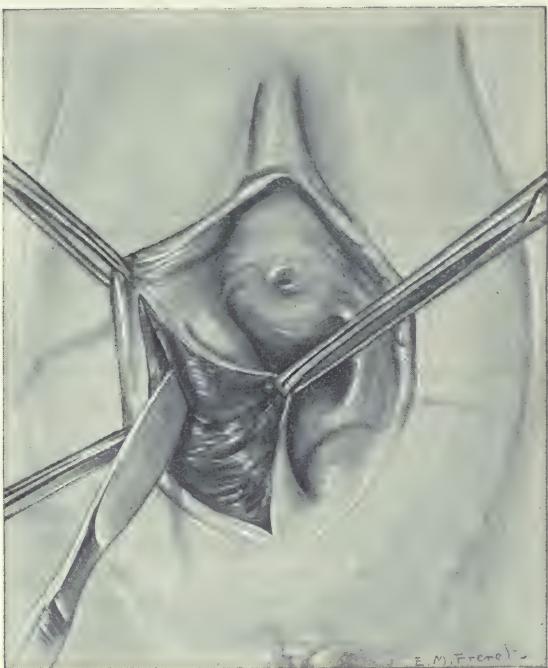
Fig. 10.—Vaginal route. The dissection continued—separation of vaginal flap to expose subpubic triangle on the right side.

through fascia, levator, etc., thus forming always the "sliding" type of hernia. The kinking and partial obstruction at the rectosigmoidal junction explains the rectal symptoms and their intermittent character.

ETIOLOGY

Primarily, of course, all of the factors bearing on the etiology of all herniæ must be considered. Von Winckel in his discussion of pudendal hernia says that they are congenital or acquired. Pregnancy and parturition are the factors of most import and we find that the largest majority began during labor or were noted soon after. Difficult and instrumental cases are noted, and emphasized in the majority
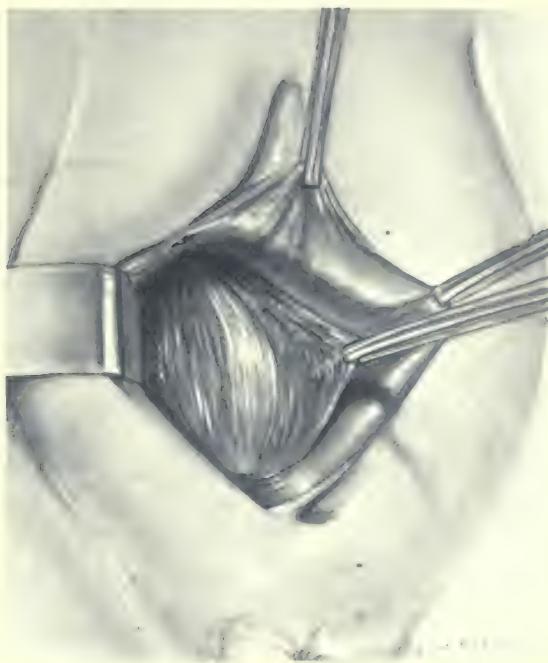
Fig. 11.—Vaginal route. Showing the right levator muscle drawn over toward left and sac (now empty and not bulging) showing through split levator. Light area is sac showing through split in muscle.
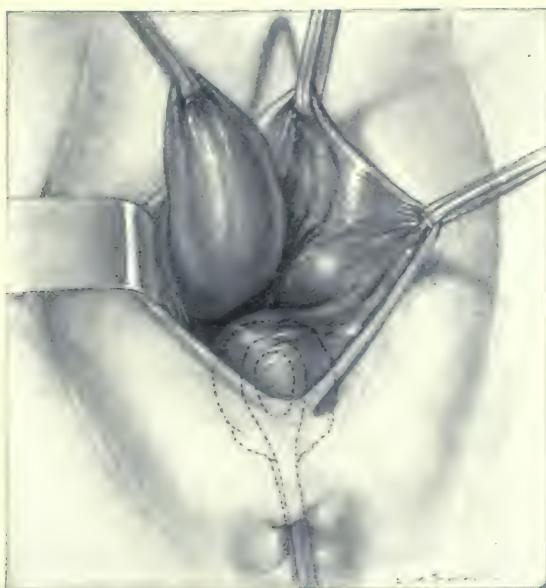
Fig. 12.—Vaginal route. The sac has been separated from edges of split levator, and the inner bundle of split muscle pushed outward to join main body of right levator muscle and sac freed to neck. Sponge in rectum.
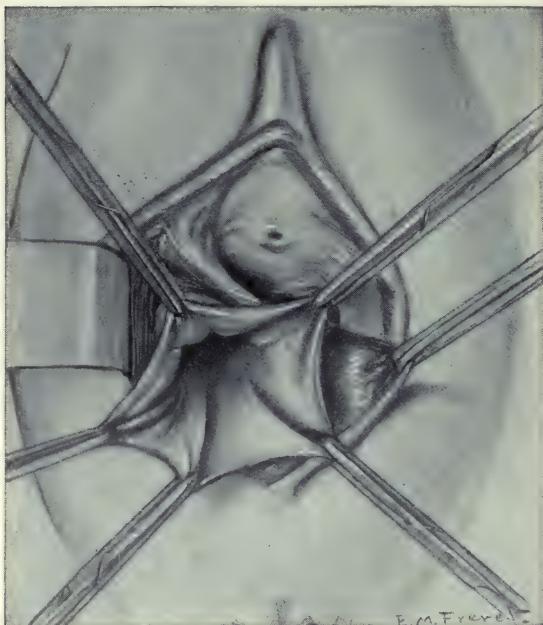
Fig. 13.—Vaginal route. Empty sac split and held open. (Finger passed into sac could easily feel internal closure of fascia—see abdominal route. Figs. 7 and 8.)
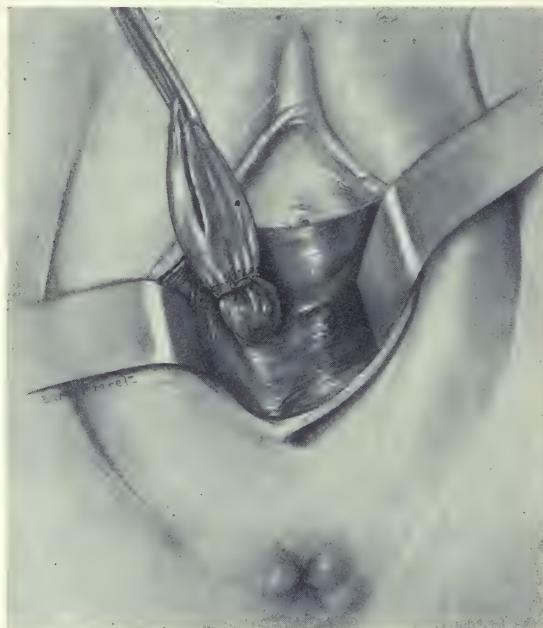
Fig. 14.—Vaginal route. Transfixion and ligation of sac before excision. The sac was actually ligated at a higher level than represented here.

of cases. This was true of my case. It is evident that trauma is a direct and activating factor. Age naturally would fall during the child-bearing period. The youngest is Cooper's case, 22 years old, and the oldest is 51 years, von Winckel's case. Not a single verified case is reported in the male. Von Winckel, in discussing this point, refers to a male infant, age 6 weeks, who had a protrusion through the sacrum opposite the second spinus process, the size of a walnut, which bulged and increased in size on coughing and straining and which underwent spontaneous cure as the bone developed and the opening closed. However, this case has been excluded by most authors as
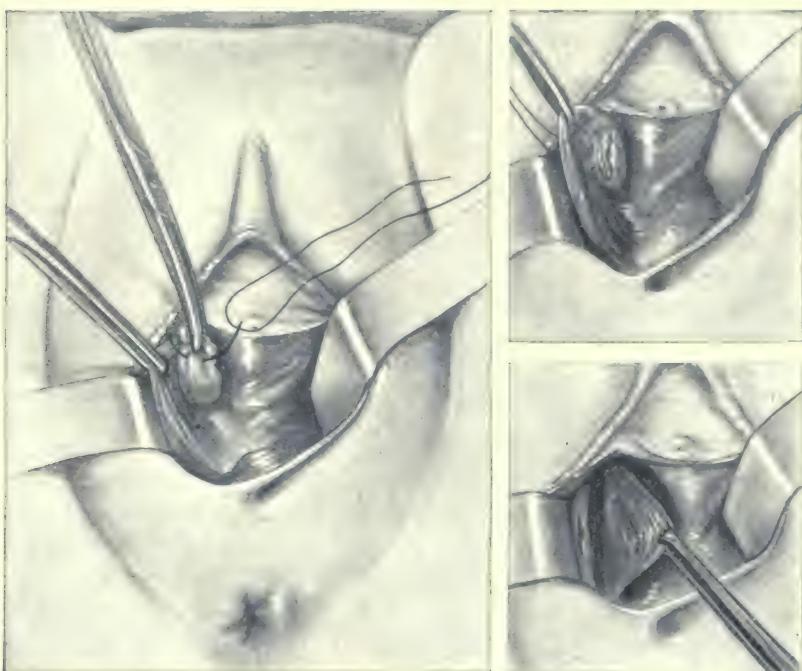
Fig. 15. Vaginal route. Showing fixation of neck of sac behind "white line" and behind the broad buttress of the right levator base. After this step an ordinary levator myorrhaphy and perineorrhaphy was performed.

not a true pudendal hernia and was probably a meningocele on the basis of spina bifida, and was so considered by Moschcowitz in his admirable paper. Von Winckel also mentions in the same article the case of a male child, age seven days, who presented along the left side of the pubis near the scrotum, a mass the size of a pigeon egg which was reducible. The description is too meagre and indefinite to be included as a proved case of pudendal hernia. (If these two cases could be verified and accepted they would be the only two cases in the male on record, and the only two spontaneous cases recorded.)

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

Pudendal hernia should offer no great difficulty in diagnosis. There are certain essential features which make it certain of recognition. The most important are: First, the hernia always appears in the posterior part of the labium majus. It cannot appear elsewhere and also come through the subpubic triangle. Second, the mesial half of the protrusion is covered with mucous membrane and the other half with integument. Third, associated with these two features are all the ordinary signs of hernia: impulse on coughing, reducibility, etc. A consideration of the three points mentioned above will easily differentiate pudendal from the other forms of herniæ—inguinal, femoral, etc., and from bartholinian abscess. Rectocele or cystocele can never be confounded with this type of hernia.

TREATMENT

In spite of the fact that only one pudendal hernia has been reported cured (my case here reported being too recent to speak of as cured), we feel that a better understanding of the anatomy of this condition and the classification into three types, as a practical basis for operation, will lead to a more hopeful outlook. A consideration of the anatomy as exemplified in cadaver dissection and in the pictures herewith presented will, we believe, bear this out.

The anatomy is easily understood and the principles necessary to the successful cure of all herniæ are here applicable; namely, high ligation and excision of the sac and closure of the ring. This is particularly true of the posterior and combined types in which there is a definite sac. The anterior variety, with greater destruction of the levator and fascia, especially where large areas of these structures are ruthlessly torn away by forceps operation, the problem presents infinitely greater difficulties. Even here, where ligation and removal of the sac is impossible, and the problem resolves itself into closure of the ring, an exact understanding of the anatomy and a repair based on a knowledge of the structures involved is necessary. In these extreme cases we would suggest a transplantation of the iliac fascia with pedicled flap held between the transplanted pedicled round ligaments for closing the defect above, together with a pedicled fascial transplant of fascia lata to plug the subpubic triangle below.

CONCLUSIONS

While it is obvious that no conclusions can be drawn from one case, nevertheless from a study of the 13 cases reported, the anatomy as shown in my case and in cadaver dissections studied, we feel that we are justified in making the following deductions:

1. Pudendal hernia, although extremely rare, should be easily recognized (three points).

2. All cases should be divided into anterior, posterior, or combined types as the basis of operation.

3. Every case should be submitted to operation.

4. A knowledge of the anatomy, the type presented and application of the principles of the operative treatment of all herniæ should result in a cure in a large majority of cases.

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BIHARZIAL APPENDICITIS*

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AND

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INFECTIONS of man with the trematode parasite schistosoma are very common in certain parts of the world but even in these localities cases in which the symptoms are confined to the vermiform appendix would seem to be of extreme rarity.

There are believed to be two distinct varieties of schistosoma:[1] Schistosoma hematobium, described by Bilharz in 1852, the more common of the two, found chiefly in Africa, but also in Persia, Arabia, India, Panama, Cuba and Porto Rico, and Schistosoma japonicum, found in Japan, China and the Philippines.

The commonest sites[2] of infection are the bladder and urethra, rectum, vulva and vagina. Urinary symptoms, especially hematuria, are the most common. The bladder lesions consist of patches of hyperemia which later develop a "sandy" appearance due to the presence of enormous numbers of ova. Chronic inflammation, with the formation of connective tissue, develops, which may lead to ulceration, phosphatic deposits and stone formation.

Another type of lesion is hyperplastic affecting the mucosa with the formation of papillomata, in which malignancy may develop. Fistulae, starting from the neck of the bladder or membranous portion of the urethra, are not uncommon. These arise in a mass of chronic inflammatory granulation tissue which contains large numbers of ova. Similar granulation tissue tumors may arise in the region of the external genitalia, or in the groins.

Infection of the rectum produces symptoms of dysentery with mucous and bloody discharges. Here too the lesions are chronic inflammatory with the formation of a mass of vascular connective tissue accompanied by ulceration, and also hyperplastic affecting the mucosa with the production of adenomatous polyps. Ova are abundant in the mucosa and submucosa. Most frequently the rectum only is involved but in severe cases the entire large and even the small intestine may be affected.

Bilharzia infections are much rarer in the female than the male. Burfield[3] quotes the proportion of male to female infections as 24 to 1. In women as in men the most frequent symptom is hematuria but there is often an acute vaginitis with or without involvement of the

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vulva where condylomata may be found. Horwood[4] describes the formation of a polypoid tumor of the cervix containing large numbers of ova.

Just how this parasite invades the human body is not known but presumably by way of the mouth, or through the mucous membrane of the urethra, vagina, or rectum, or possibly through the skin by means of contaminated water used for drinking or bathing. The ova, discharged in urine or feces, quickly burst, when these discharges are diluted with water and a motile ciliated embryo is extruded. It is presumably this form of the parasite which invades the tissues. It is argued that infection by mouth is improbable because these embryos seem not to survive an acidity equal to that of the gastric juice. Adult, sexually active forms are found only in the portal system. Worms in copula, have been found in cases of rectal infection in the hemorrhoidal veins, with large numbers of eggs in the surrounding rectal tissues. Similarly worms have been found in the vesicoprostatic plexus with eggs in the bladder mucosa. Postmortem large numbers of eggs are commonly found in the liver. It is assumed that early development takes place in the liver and that the worms travel against the portal stream to its tributaries about the rectum, bladder, or elsewhere and that eggs are here laid and either carried back to the liver by the blood stream or distributed locally. Possibly there is a greater disposition to the latter when the vein is completely blocked, as it apparently frequently is, by the worms and the endarteritis produced by them. The possibility is not to be dismissed, however, that the embryos reach their sexually mature form in the small vessels at or near the site of invasion and there produce their eggs which are distributed locally and to the liver.

The writers have been able to find but two reported cases in which symptoms of Bilharzia infection were confined to the appendix. One, by Burfield,[3] was a male, thirty-six years old, who came from South Africa in 1905 for the treatment of a sinus of 18 months' duration in the right gluteal region. In 1899 he had had a slight attack of appendicitis. In 1902 a swelling appeared in the right iliac region which, a few months later, pointed in the right lumbar region, was incised and drained for a long time. In 1904 an abscess appeared in the right gluteal region. The appendix region was explored and a retroperitoneal abscess found which was drained posteriorly and was still discharging when seen by Burfield in 1905. Burfield operated and found the distal portion of the appendix sloughed. The proximal portion he removed. Sections showed abundant ova in the submucosa and the lesions found, according to his pathologic description, correspond almost exactly to those in the appendix to be described. The patient had no symptoms of genitourinary or rectal involvement and

Burfield believes that the case was primarily an ordinary acute appendicitis with abscess formation and that infection with schistosoma occurred only secondarily through the resulting sinus. In the light of the chronic history and with the knowledge from the case here reported that schistosoma can produce an appendicitis without clinically evident lesions elsewhere, it seems more probable to the writers that the primary lesion was produced by schistosoma.

The other case is one reported by Kelly.[5] He says: "Aireton relates a case of Bilharzia disease in which eggs of the parasite were lodged exclusively in the appendix." There is no further description of the case and no reference.

The writers have seen sections of one appendix, other than that here reported, which was infected with schistosoma. These slides are in the collection of the Department of Pathology in the College of Physicians and Surgeons, New York, and are from a young Chinese autopsied in Singapore by Dr. W. G. MacCallum. The writer is indebted to Dr. MacCallum for examining some of the slides from the case here reported and for an account of his own case. Briefly, the man suspected of beriberi was infected with ascaris, ankylostoma, and Schistosoma japonicum. The spleen and liver were both enlarged, the latter containing large numbers of schistosoma eggs. The stomach, duodenum, pancreas, and adrenals were normal. The upper ileum contained ascaris and ankylostoma. In the colon were yellowish patches which showed thousands of schistosoma eggs. The bladder was normal. Dr. MacCallum[6] says, "The liver, colon and mesenteric glands show abundant eggs surrounded often by giant cells and tubercle-like capsules. These eggs are about the same size of those in your specimen. I can see no spines but in sections with shrunken eggs that would be very difficult to be sure of anyway. The lesion is almost exactly the same as my sections show. Apparently though it should be the African form and not the Eastern one."

CASE 1.—Mrs. W. J. M., age twenty-five, married one year, born in Scotland; *lived in South Africa* until fifteen. Measles lightly at four; scarlet fever and diphtheria, mild attacks, at eighteen. Usually well and vigorous but always somewhat underweight. Moderate constipation, about five years, necessitating daily laxatives. Nothing abnormal ever noted in appearance of stools. Menses began at twelve, epochs every twenty-one to twenty-eight days, scanty, lasting but two days and with great pain first day. No contraceptive measures taken but never pregnant. Slight mucoid leucorrhea several years.

Chief complaints: Sterility. Dysmenorrhea. Frequent dull pains in right lower quadrant of abdomen for nearly two years. These pains are localized, bear no relation to urination, menstruation or digestion, and are not influenced by exercise.

General physical examination revealed nothing abnormal. Abdomen thin and slightly retracted. Right kidney just palpable, felt normal. Slight tenderness on deep palpation over cecum but no abnormality felt.

Pelvic examination disclosed a uterus two-thirds normal size, anteflexed, retrocessed, mobile, with small cervix and tiny external os. Appendages normal.

Urinalysis: Specific gravity, 1025, acid, no albumin or sugar, no formed elements in sediment. Wassermann negative. Blood, reds, 4,256,000; hemoglobin, 90 per cent; leucocytes, 8,050; polys, 62 per cent; lymphocytes, 38 per cent.

Preoperative diagnosis: Undeveloped uterus, anteflexed, retrocessed with stenosis of cervix. Chronic appendicitis.

Operation, Woman's Hospital, by Dr. Bullard, Feb. 26, 1921: Dilatation of cervix and insertion of stem pessary; appendectomy; Simpson technic of shortening round ligaments. Tubes and ovaries normal. Uterus normal but small, retrocessed and very mobile. Gall bladder and kidneys felt normal and all other structures seen or felt seemed to be normal. The appendix was about 2 inches long and of average diameter. There were no adhesions anywhere about. The entire mesoappendix and the distal two-thirds of the appendix were thickly studded with tiny grayish-white nodules resembling tubercles. The appearance was of a chronic lesion. The cecum was not involved and careful inspection of intestines, omentum and pelvic organs failed to find any more such lesions.

There was an uneventful convalescence.

Two months later the stem pessary was removed. Pelvic examination found uterus in normal position and adnexae normal. No tenderness over cecum. No abdominal pain or dysmenorrhea since operation.

PATHOLOGICAL REPORT

The specimen is an appendix 55 mm. long x 7 mm. in diameter with an attached thick mesoappendix. The lower half of the appendix and especially the mesoappendix show on the surface numerous small nodules up to 1 mm. or slightly more in diameter. These resemble tubercles but have a more glistening, translucent appearance than conglomerate tubercles, which have reached the size of these lesions, are apt to have. On gross section, except for moderate apparent fibrosis, there are no definite lesions. The lumen is empty.

Microscopical.— Sections show very numerous nodular lesions about the size of and very similar in appearance to tubercles. None of these are seen in the mucosa, there are a moderate number in the submucosa, and none in the muscular layers, but in the serosa and throughout the entire thickness of the mesoappendix, especially close to the appendix they are extremely numerous. In these nodules are seen sometimes one ovum, sometimes six or more, with a very definite cell membrane. Sometimes they are of fairly regular oval form but more often partially collapsed. The shell may be empty, filled with granular material, or contain numerous very small, round, hematoxylin-staining bodies, resembling nuclei. Some ova are calcified. By the search of serial sections two ova were found which possessed what was apparently a spine, in both cases terminal. One of these ova is shown in Fig. 2. Frequently one or more giant cells with many nuclei lie adjacent to or apparently completely envelope an ovum. Rarely an ovum is seen lying in the tissue with practically no surrounding tissue reaction but nearly always the tubercle-like nodule is seen consisting of large mononuclear cells, with an occasional giant cell, immediately surrounding the ovum and outside of this a fibrous capsule. In what are presumably the older lesions dense fibrous tissue immediately surrounds the ovum with very few cells of any kind. In large areas of the mesoappendix the tissue between the nodules is densely infiltrated with neutrophile and eosinophile polymorphonuclear leucocytes but no tissue necrosis is seen anywhere.

When the diagnosis was made, by examination of sections of the appendix, it

Fig. 1.—Shows three tubercle-like nodules in the mesoappendix. In the upper is an empty shell enveloped by a giant cell. In the lower left are seen two giant cells only. In the lower right are six ova, the one farthest to the left being partially enveloped by a giant cell.

Fig. 2.—Shows a very fibrous nodule in the center of which is a single ovum showing what is apparently a polar spine with a giant cell on either side.

seemed probable that all information possible had not been obtained from the blood count made by an interne on Feb. 25 and recorded simply as leucocytes, 8,050, polymorphonuclears, 62 per cent, lymphocytes, 38 per cent; consequently the patient was asked to report for a blood examination which she did on April 1, 1921. Her leucocyte count at that time, done by the writer, was 5,600; polymorphonuclears, 24 per cent, small lymphocytes, 52 per cent, large mononuclears, 7 per cent, eosinophiles, 17 per cent. A stool brought in was carefully searched but no ova were found.

The patient sailed for Scotland in May, 1921, bearing a record of her case to Professor Jonathan Meakins, University of Edinburgh. A report from him stated his concurrence in the diagnosis of intestinal type of bilharzia. "I think it probable that the parasite has become lodged in the muscular coat or probably the subperitoneal layers where it continues to exert a systemic reaction as evidenced by the eosinophilia, although not discharging ova into a lumen of the bowel. Professor Ashworth could find no ova in the stool." He concurred in Professor Meakins' opinion. Sodium antimony tartrate was given intravenously in ascending doses of a 2 per cent solution every 2 days beginning with 1 c.c. When a 4 c.c. dose was reached no further increase was made. After 7 doses the patient had taken a total of 22 c.c. Each dose was mixed with 50 c.c. of normal saline.

Patient returned to New York in July, 1921, free from all symptoms. Abdominal and pelvic examination negative. Eosinophilia, 10 per cent. Three doses of 2 c.c. each, of sodium antimony tartrate, were given intravenous'y July 12 and 15 and Aug. 9. Eosinophilia Aug. 9, 8 per cent. Patient had by then gained in weight and strength and tiring of treatments, refused more.

On May 2, 1922, the patient's urine was normal. Her blood count was as follows: Red cells, 4,300,000. Hemoglobin, 85 per cent. White cells, 10,000. Polymorphonuclears 68 per cent, small lymphocytes 23 per cent, large mononuclears 7 per cent, eosinophiles 1.5 per cent, basophiles 0.5 per cent.

The patient went to Scotland again in June, 1922, and a report from Professor Meakins, dated August 10, 1922, stated that the patient was in excellent health and that careful observation failed to disclose any evidence of bilharzia remaining.

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TECHNIC OF REPAIR OF ENTEROCELE (POSTERIOR VAGINAL HERNIA) AND RECTOCELE

As an Entity, and When Associated with Prolapse of the Uterus*

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THE subject of this paper is limited to hernias involving the posterior vaginal wall, which we frequently encounter and recognize under the designation of rectocele, and to the much rarer hernia which is made up of the culdesac of Douglas, with its intestinal contents dissecting its way downward between the posterior vaginal wall and the rectum, known as vaginal enterocele or posterior vaginal hernia.

The common condition of rectocele is the result of impairment of the function of the pelvic floor (the inability to properly close the vaginal mouth), due to injury in childbirth, thus allowing the vaginal wall to roll downward and outward with the attached rectum. This anatomic change in the relation of the parts alters the normal mechanism of defecation, the direction of the fecal current being changed so that the anterior rectal wall and the posterior vaginal wall receive the brunt of the strain and, consequently, protrude more and more until a distinct rectal pouch is formed, which renders complete emptying of the rectum difficult. In cases in which the fascial support of the vaginal wall has been torn or is attenuated, the rectocele may develop to a large size, with resulting aggravation of symptoms.

The usual methods in vogue for curing this hernia are based on the principle of either denudation of the posterior vaginal tissue and approximation of the cut edges or resection of the excess vaginal wall with plication of the bowel. The result, so far as the bowel is concerned, is to throw it into folds, which must tend to be smoothed out by the daily passage of fecal masses, especially if constipation exists. In all these operations, a perineorrhaphy is relied on to close the vaginal orifice and thus prevent further descensus of the vaginal walls. In the majority of cases with a small or moderate sized rectocele, these methods are satisfactory in their results, the so-called "interposition" or levator muscle operation being superior to the typical Emmet, in my opinion, so far as the rectocele is concerned.

In large rectoceles, however, the usual operative procedures do not

give as perfect a permanent result as is desired. For the last twelve years, I have been employing the principle in curing rectocele that is so successful in cystocele when the bladder is separated from its vaginal and uterine attachments and carried to a higher position, as in the technic of Goffe. I published a report of the operation in 1913.[1]

The operation consists, first, in completely separating the rectum from the posterior vaginal wall as far up as the culdesac of Douglas, and then sliding the loosened rectal pouch high up along the vaginal
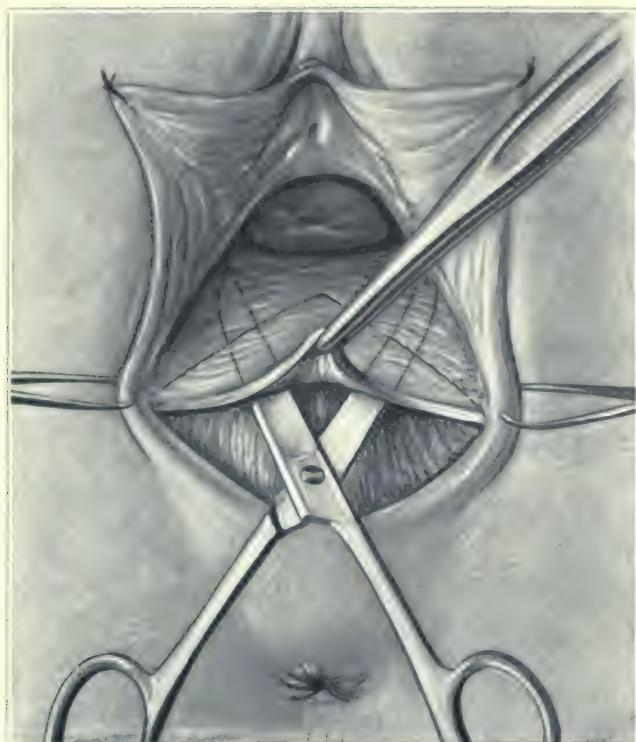
Fig. 1.—Technic of rectopexy for rectocele; the vagina is separated from the rectum with scissors; the dissection extends well above the line marked for the excision of the vaginal wall.

wall by means of a suture. Thus, the denuded rectum is carried up and placed so as to adhere strongly to the upper undamaged third of the posterior vagina, which is above the former site of the rectocele. The pouched part of the vaginal wall which entered into the formation of the rectocele is then cut away, and the operation completed by a perineorrhaphy, in which the pubococcygeal portion of the levators are exposed and approximated in front of the rectum, thus making a strong barrier to further descent. An extensive experience with this technic in many hundreds of cases in my hands

has proved the soundness of the principle employed and has been uniformly successful in permanently relieving these patients of their symptoms.

Bissell has applied the principle of fascia lapping in the cure of this condition. My objection to this technic is that the normal balloon shape of the vagina is liable to be changed by it, the upper vagina being considerably reduced in size, and that it is too complicated and time consuming, although the results Bissell has obtained are excellent.[2]

Fig. 2.—Technic of rectopexy for rectocele: The rectopexy suture that is to draw up the rectal pouch to the upper undamaged part of the vagina is in place.

Posterior vaginal hernia, or "enterocele," has been considered a very rare condition, and the textbooks either ignore it entirely or give but a few lines calling attention to its infrequency. Likewise, a search of the literature shows that very few cases are recorded. Sir Astley Cooper, in his classic work on hernia, in 1804, published an illustration of an undoubted case. Fordyce Barker and T. Gaillard Thomas have reported cases, and, in 1916, Hartman[3] of Paris published a typical case, with the technic he employed for its cure from below. The most recent report I have been able to find was made

by Sweetser,[4] in 1919, illustrative of the extreme type in a nulliparous woman.

The rarity of this condition is undoubtedly due to the obliquity of the pelvic cavity in the erect posture, the intraabdominal pressure thus being deflected forward, and to the very strong pelvic and rectovesical fasciae whose fibers are intimately interwoven with the walls of the canals passing through the pelvic floor. Moschcowitz calls attention to the fact that this fascia has a funnel shape attachment to the rectum and that a defect here will allow the intestine

Fig. 3.—Technic of rectopexy for rectocele: The excess vaginal wall is cut away along the line previously outlined, the edges are united by interrupted sutures, and the perineorrhaphy is completed with an approximation of the levators and a subcuticular skin suture.

to push through along the rectal wall to the levators, pushing the peritoneal lining of the culdesac ahead of it. Such a congenital defect in the fascial attachments would therefore, account for such condition in a virgin. Pregnancy and labor causing stretching or separation of the fibers of the fascia would account for the acquired form.

My interest in this subject has been aroused during the last four years as a result of encountering partially satisfactory results in several cases of prolapse of the uterus in which I had employed the

Fig. 4.—Enterocele: Frozen section from Halban and Tandler, demonstrating the relation of a deep culdesac of Douglas to prolapsus. The pouch filled with intestine exerts traction on the cervix.
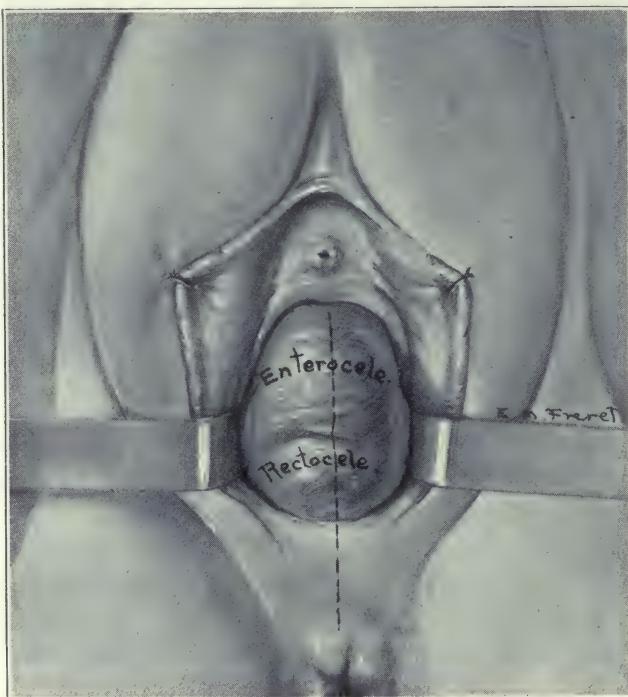
Fig. 5.—Enterocele: line of incision.

Mayo technic of vaginal hysterectomy and the interposing of the united broad ligaments under the bladder. While the cure of the prolapsed bladder and anterior vaginal wall was all that could be desired, a well-marked enterocele protruded from the vulva orifice in these cases, necessitating a second operation to establish a cure. A careful study of the culdesac of Douglas in all cases of prolapse of the uterus during this period has convinced me that an enterocele, either beginning or well developed, is present in a far larger proportion of these cases than we have realized, and

Fig. Enterocele: the enterocel exposed and its relation to the rectocele.

that it is necessary to recognize and meet this condition with an appropriate technic at the time of the operation for the cure of the prolapse of the uterus, in order to prevent a certain proportion of partially satisfactory results. I am also convinced that enterocele (of the lesser types) without prolapse of the uterus is more frequent than we formerly believed, and that it is frequently overlooked and classed as a rectocele, both conditions being frequently present. The differential diagnosis with the finger in the rectum is easily made but not often employed. In the past four years at the Woman's Hos-

pital, I have had occasion to operate on fourteen patients having abnormally deep culdesacs, with and without an associated uterine prolapse. Of these fourteen patients, three required a second operation because of my failure to appreciate the importance of investigating the depth of the culdesac at the time of the original operation. Zuckerkandl, Freund and others have shown that the culdesac of Douglas normally extends to the levators in the fetus and that its depth gradually decreases from this time until puberty, when it

Fig. 7.—Enterocele: The peritoneal pouch of Douglas is dissected out, opened, clamped and ligated.

reaches the level of the second or third sacral vertebra.   Daniel Jones[6] of Boston has pointed out that a deep culdesac is an important factor in favoring or producing prolapse of the uterus, and he states that downward pressure made in the culdesac against the posterior vaginal wall will demonstrate a strong pull on the uterus.   He advocates the closure of the culdesac on this account.   Jones believes that this accounts for uterine prolapse in virgins, as these patients always have a deep posterior culdesac of congenital type.

The value of the technic of Moschcowitz for the cure of prolapse

of the rectum lies in the fact that the closure of the Douglas pouch throws the weight of the intestines forward onto the bladder, symphysis and anterior abdominal wall, with the patient in the erect posture; while a deep culdesac allows the weight of the intestines and the pressure to come on the anterior rectal and posterior vaginal wall.

In view of my experience and in the light of the foregoing statements, it is now my custom to obliterate the pouch of Douglas by the vaginal or abdominal route, as part of the technic in all cases of operation for prolapse of the uterus. In cases of enterocele without
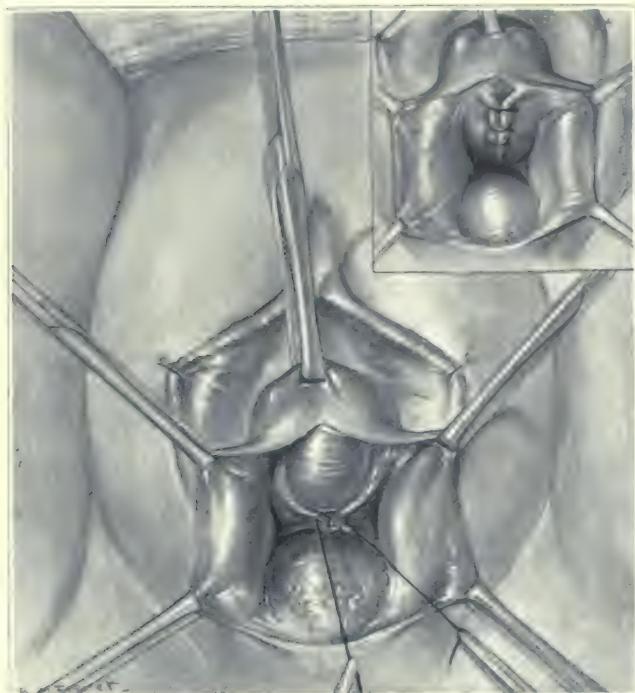
Fig. 8.—Enterocele with uterus retained: The uterosacral ligaments are united with interrupted linen sutures, closing the entrance to the culdesac, and continuous catgut sutures obliterate the space.

uterine prolapse, the posterior vaginal wall is opened in the midline for its entire length, and the peritoneal sac of Douglas is dissected free up to the uterosacral ligaments. A sponge stick in the rectum serves as a useful guide. The sac is ligated and cut off, and the uterosacral ligaments are united with interrupted Pagenstecher linen sutures as close to the rectum as possible. The denuded space is obliterated with continuous buried catgut sutures, and the vagina is closed in the usual manner. In cases associated with prolapse of the uterus, in which the Mayo technic is employed, the obliteration of the culdesac is easily accomplished after the uterus has been cut

away from the broad ligaments. A finger in the pouch demonstrates its exact location and a median vaginal incision exposes the sac so that it can easily be dissected out, up to the region of the uterosacral ligaments, where it is closed by a suture and cut off. The uterosacral ligaments are then united with linen sutures and the denuded space closed with continuous buried catgut sutures. After the culdesac is obliterated in this manner, the broad ligaments are sutured together and interposed beneath the bladder in the usual way, and a perineorrhaphy completes the operation. The obliteration of the culdesac
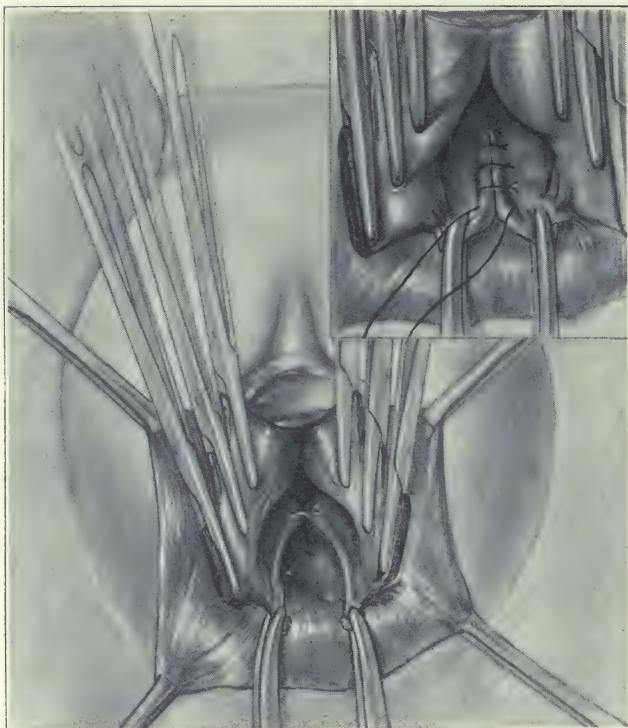
Fig. 9.—Enterocele with uterus removed. The clamps are on the broad ligaments, and interrupted linen sutures unite the uterosacral ligaments after the removal of the peritoneal pouch of Douglas.

can be accomplished in a similar manner from above if an abdominal operation is indicated.

CONCLUSIONS

1. In large rectoceles, the usual operative technic of Emmet or Hegar does not give a permanent satisfactory result.

2. In these cases, a technic may be employed which insures a cure by treating the rectocele as a hernia and anchoring the rectal pouch in a higher position on the undamaged portion of the vaginal wall, where the fascial supports of the canal are intact.

3. Posterior vaginal hernias, or "enterocele," while rare in the extreme types, are far more frequent in the lesser degrees than is usually realized.

4. A deep culdesac of Douglas may be congenital or acquired, and is an important factor in the cause of uterine prolapse.

5. It is frequently not recognized in many cases of prolapse of the uterus, and the failure to correct it is a common cause of unsatisfactory operative results.

6. The technic of the obliteration of the pouch of Douglas by the vaginal or abdominal route is not difficult, and it should be a part of the procedure in operations for uterine prolapse.

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THE INCIDENCE OF PULMONARY EMBOLISM AND THROMBOSIS FOLLOWING HYSTERECTOMY FOR MYOMATA UTERI*

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INTRODUCTION

A S Harvey was the discoverer of the circulation of the blood, so Virchow is the discoverer of the pathologic conditions of the blood thrombosis and embolism.

During the years 1846 to 1856 Virchow gave to the world his doctrine of embolism based upon "anatomical, experimental and clinical investigations which for completeness, accuracy and just discernment of the truth must always remain a model of scientific research in medicine." I shall quote both Virchow and Welch freely in all that pertains in this paper to the pathology of these conditions.

PATHOLOGY

We may define an embolism according to Welch as an impaction in some part of the vascular system of any undissolved material brought there by the blood current. It may be solid, liquid or gaseous, infective or noninfective. An embolism is generally understood to be a part or the whole of a detached thrombus which in turn may be defined as a solid mass or plug formed during life in the blood vessels or heart from the constituents of the blood, but an embolus may also be made up of bits of tissue, fat tissue cells, or parenchymatous cells, fragments of diseased heart valves or foreign bodies transported through the arterial system, and sometimes by the lymphatic system. The size and shape of the embolus and the direction and volume of the blood stream determine the route; the size and angle of the branches of the blood vessels determine the stopping point of the plug. Retrograde or paradoxical embolism occurs when an embolus is transported in the veins in a direction opposite to that of the blood stream and is caused by a back current produced by pressure on the vein when there is some obstruction to the flow, as a tumor, or in severe coughing, especially if the valves in the veins are defective.

The result of an embolus depends upon its size and septic charac-

ter. If the plug is large enough to completely obstruct a main branch
of the pulmonary artery or one of the coronary arteries of the heart,
or the bulbar vessels, death is immediate. If obstruction is not com-
plete the embolus in its turn becomes then the starting point of a
secondary thrombus and may completely block the vessel or if it has
lodged at the bifurcation of a vessel, a "riding embolus," it may in
time block both branches. If the emboli are so small that only arte-
rioles or capillaries are plugged or if anastomoses are abundant no
circulatory disturbance of any consequence results, but if no adequate
collateral circulation be established the result to that part supplied
by the plugged end is degeneration or death. An infarct is then an
area of dead tissue perhaps best described by Cohnheim as a "coagu-
lative necrosis." It is usually cone or triangular shape with its base
toward the periphery of the organ, and is sharply circumscribed and
hard in consistency, white, yellowish white or red in color if hemor-
rhage has occurred. If the venous pressure is high and the resistance
in the tissues low, as in the spongy tissue of the lungs or in the intes-
tines, the infarct is hemorrhagic but the process of coagulation necro-
sis is the same whether the infarct is red or white. If the embolus be
septic this coagulation necrosis furnishes a favorable nidus for local
or pyemic infection.

The most constant symptom of embolism is pain which has been at-
tributed to various causes, but the most probable seems to be local
irritation produced by the sudden distention caused by the plugging
of the vessel and the irritation to sensory nerve endings in the vas-
cular wall. The pain is sudden in occurrence, sharp in character and
may be accompanied by chills or chilly sensation; more especially
is this so if the embolus be septic. Other symptoms depend upon the
artery obstructed together with the degree of local anemia and in-
fection produced.

It is not the purpose of this paper to deal with the terminal result
of embolism. The sudden onset of a pulmonary embolus after the
apparently complete recovery from an operation with the blocking
of the trunk of one or both main branches of the pulmonary artery
accompanied by sudden intense dyspnea, cyanosis, exophthalmos, syn-
cope, and death does not demand differential diagnosis. The condi-
tion could not be mistaken—nor the picture once seen forgotten.
But while statistics are very definite as to the occurrence of embolism
with fatal results they are not at all clear as to the occurrence of
postoperative pulmonary conditions which may possibly owe their
origin to small emboli in the lungs. The presence of an embolus is
known only by the disturbance it causes and based upon this the or-
der of frequency is the pulmonary, renal, splenic, and cerebral ves-
sels, less frequently the iliac, lower extremities, hepatic and gastric

arteries, the mesenteric and coronary arteries of the heart. An infarct in the liver, spleen or kidney may not give physical signs sufficiently definite to warrant the diagnosis because of the free anastomoses in these organs unless an embolism in some other part of the body arouses the suspicion but a pleuritic friction rub or sudden appearance of blood and pus in the urine may help to establish the diagnosis of embolism, especially if disease of the left heart exists. The frequency of pyelitis following operation may perhaps be due to infected emboli, for Welch has shown the kidney to be the most frequent seat of abscesses following intravascular infection of the pyogenetic staphylococci in rabbits. While embolism and thrombosis of the mesenteric arteries are not common their occurrence might perhaps be more often found if sought for, as Watson collected eight cases which had occurred in a single year in Boston. The collateral circulation is greater in that portion of the intestine supplied by the inferior mesenteric artery and consequently the disturbance less. The complete closure of the superior mesenteric artery, however, produces grave intestinal symptoms usually diagnosed as due to peritonitis. The abrupt onset, violent intestinal peristalsis with vomiting of blood, and the tarry stools followed by paralysis of the intestine should at least arouse the thought of a hemorrhagic infarct.

POSTOPERATIVE PULMONARY COMPLICATIONS

The incidence of pulmonary embolism varies with the character of the operation and the operators. In a series of 5,710 operations done by ten different operators, pulmonary embolism occurred from nineteen hundredths of one per cent to five and three-tenths per cent.

Deaver in	750 Cases	1.73%
Frank in	400 Cases	1.75%
Spencer Wells in	137 Cases	3.00%
Schauta in	131 Cases	5.3 %
Chevreux in	820 Collected cases	2.7 %
Martin in	97 Collected cases	1.2 %
Kustner in	100 Collected cases	3.0 %
Clark and Norris	213 Collected cases	0.4 %
Broun in	1,500 Collected cases, Woman's Hospital	0.4 %
Peter Bent Brigham in	1,562 Cases	0.19%
Total	5,710 Cases 0.19	5.3 %

Cutler and Hunt in a recent study of postoperative lung complications give a summary of 18,000 laparotomies from eleven different hospitals with the incidence of pneumonia alone of nearly 4½ per cent (4.48 per cent). A total incidence of pulmonary emboli or postoperative pneumonia in 23,700 operations of 9½ per cent (9.51 per cent). Whipple, in his study for 1915-16 of postoperative pneumonia only in the Presbyterian Hospital, reported 97 cases in 3,719 anesthesias

or 2.6 per cent, while Burnham, in 1914, reported from the same hospital 59 cases of pleurisy (0.45 per cent) and 6 cases of empyemia following 13,000 operations (0.4 per cent), or nearly one-half of one per cent (.49 per cent), approximately 3 per cent for the combined figures. Cutler and Hunt reported that at the Peter Bent Brigham Hospital of 1,562 patients operated upon 55 or $3\frac{1}{2}$ per cent (3.52 per cent) developed a definite postoperative pulmonary complication.

When one considers that at both these hospitals the operations are done by skilled operators, the anesthesia is administered by trained anesthetists and every pre- and postoperative care is given to minimize the risks incident to the surgical procedure that can be thought of in a hospital with the highest standards, one cannot fail to be impressed with the frequency of lung complications following operations and ask the cause.

If one believes, as do Cutler and Hunt, that their origin is to be found in pulmonary emboli, which is a conclusion that has been arrived at also in a recent review by Hampton and Wharton of postoperative lung conditions in Johns Hopkins Hospital, one has abundant proof for this conclusion in a study of the pathologic lesions of the lungs. For it is in the lungs that one would expect to find most frequently thrombi or emboli. Welch says that primary thrombus of the pulmonary arteries, particularly of the medium sized and smaller branches, is more frequent than is represented in text books, and Pitt states that thrombi are more frequent in the pulmonary arteries than in any other vein or artery in the body. (Clinically a thrombosis of the pulmonary artery produces symptoms similar to a pulmonary embolus.) The origin of the large emboli is in a peripheral venous thrombosis or diseased right heart, but pulmonary hemorrhagic infarcts are usually small and multiple and found in the lower lobe more commonly on the right side and come from a diseased right heart more frequently than from a peripheral thrombus.

TIME OF OCCURRENCE

The time of the occurrence of fatal pulmonary embolism we *know* is frequently soon after operation. Hampton and Wharton reported that half of their cases of embolism developed within the first six days, one at the end of twenty-four hours and one fatal attack occurred three hours after operation. Gibson says 60 per cent of the cases of embolism occur in the first week after operation and more deaths in the first and second twenty-four hours. Of three cases of fatal embolism at the Woman's Hospital following 617 hysterectomies for myomata uteri, three occurred in forty-eight hours—six days— and eight days respectively after the operation. Küstner reports two cases two and three hours each after operation.

PHYSICAL SIGNS AND DIFFERENTIAL DIAGNOSIS

The autopsy picture of the lungs following acute embolism is edema and congestion. If minute emboli were showered into the lungs from the operative field during anesthesia the congestion produced would give the physical signs we often attribute to the anesthetic and designate bronchitis, pleurisy or ether pneumonia. The clinical course, however, differs from that of inflammatory conditions of the lungs. The initial symptom is usually localized pain, accompanied with dyspnea, and possibly a chill, soon followed by bloody expectoration which in the absence of tuberculosis is almost pathognomonic. Associated with the sputum is evidence of circumscribed consolidation and subcrepitant râles with moderate elevation of temperature and moderate leucocytosis. If the process is not an infective one the condition improves in three or four days, to be followed in a few days' time perhaps by the appearance of a thrombus in the lower extremities. If the process is infective an inflammatory condition results which may be recovered from or may terminate in gangrene of the lung or empyema. The differential diagnosis from pneumonia when the emboli are bland is based upon the short duration of physical signs in the chest, the character of the sputum which is never tenacious and prune juice in color, but copious, watery, and contains flecks or streaks of blood. The absence of evidence of consolidation, cyanosis, high sustained temperature, leucocytosis and general appearance of severe illness differentiate the condition from pneumonia. It is of considerable interest that these pulmonary symptoms have been described by Dr. Lewis A. Conner, of the New York Hospital, as the "Premonitory Signs of Venous Thrombosis" in a series of studies on typhoid fever. Dr. Conner believes that there are three well marked groups, viz.: "Group 1.—Those in which friction rub or crepitant râles over a small area were the only signs. These signs often lasted only two or three days. Group 2.—Cases in which the signs were those of a small circumscribed pneumonia. The area of consolidation disappeared within three or four days. These signs were almost always in the lower lobes. Group 3.—Cases with signs of extensive plastic pleurisy or of pleural effusion." As these premonitory signs and the clinical course are very similar to those seen in two cases which occurred almost simultaneously on the division of Dr. George Gray Ward in the Woman's Hospital and in connection with the x-ray pictures of the cases it may be of interest to give the histories somewhat in detail.

CASE 1.—Mrs. J., Case No. 27627, Woman's Hospital, age thirty-four, colored. Heart and lungs normal, red cells 4,500,000, hem. 95, white cells 8,000, polymorphonuclear 60 per cent. Operation, March 22, 1921, by Dr. Ward, supravaginal hysterectomy, double salpingo-oophorectomy and prophylactic appendectomy. Dura-

tion of the operation, one hour, five minutes. Pathological report: Large fibro-myomata uteri, chronic salpingitis and perisalpingitis, perioophoritis, appendix normal. First day after operation temperature 102, pulse 120, respiration 28. That night the patient complained of severe pain in the chest. Second day after opera-tion, temperature 101.8, pulse 120, respiration 44. Pain in the chest had increased and there was now cough and bloody expectoration, dullness at the base of the right lung posteriorly and fine râles but no increase in respiratory sounds.

Third day after operation, temperature 101, pulse 112, respiration 40. The patient was seen in consultation by the internist at the hospital and as there was now slight dullness, increase in voice and fine râles in an area at the base of both lungs and friction râles at the right base anteriorly, the case was diagnosed as bronchopneu-monia associated with pleurisy.

Fourth day after operation, temperature 100.6, pulse 100, respiration 38. Patient feeling much better.

Fifth day after operation, temperature 100.4, pulse 100, respiration 36. The patient was still coughing, had copious, watery, blood-tinged sputum but the lungs were almost clear. The report from the laboratory was pneumococci in the sputum, epithelial cells numerous, but practically no leucocytes. The patient was now com-plaining of pain in the lower left quadrant of the abdomen, and as the thought of thrombosis was now in mind she was sent at once for an x-ray of the chest, which was negative for lobar pneumonia.

Seventh day after operation and fifth day after onset of lung symptoms the patient complained of chilly feeling and pain in the left leg which was found to be swollen from a thrombosis of the left femoral vein.

The rest of the convalescence was normal. The wound healed by primary union. The cough and bloody sputum ceased by the ninth day, but the temperature, pulse and respiration were not normal until the twenty-second day.

Case 2.—Mrs. H., Case No. 27639, Woman's Hospital, age twenty-six, colored, heart and lungs normal, red cells 4,350,000, hem. 98 per cent, white cells 6,000, poly-morphonuclear 64 per cent.

Operation March 22, 1921, by Dr. Farrar. Resection of right Fallopian tube for an unruptured tubal pregnancy. Duration of the operation 20 minutes.

During the operation the pulse was reported by the anesthetist to have become very rapid and poor in quality, and the respiration shallow; the operation was hastened. The disturbance was only temporary and she left the operating room in good condition. First day after operation temperature 99.8, pulse 112, respiration 24. The convalescence was negative until the seventh day after operation when the patient complained of nausea and vomited blood-tinged fluid. The vomiting con-tinued until the next day when the patient began to cough and expectorated bloody fluid which was negative for tubercle bacilli but contained pneumococci type IV, tem-perature 98.4, pulse 126, respiration 28. The physical signs were friction rub and subcrepitant râles. The x-ray plates were negative for tuberculosis or pneumonia.

Twenty-seven days after operation the patient complained of pain in the lower right pelvis.

Thirty days after operation there was extreme tenderness over the right femoral vein and swelling of the right leg. As the patient is still convalescing it is impos-sible to tell the outcome. There was primary union of the abdominal wound.

Case 3.—Mrs. C., Case No. 27365, Woman's Hospital, age twenty-seven, white. Heart and lungs negative, red cells 4,800,000, hem. 100 per cent, white cells 13,200, polymorphonuclear 79 per cent.

Operation by Dr. Ward—Salpingectomy, right. Appendectomy. Simpson opera-tion for retroversion. Duration of the operation, one hour four minutes.

Pathological report—Adenomyoma of the tube. Acute appendicitis. It was noted on arrival of the patient in the Recovery Room "that the condition was good but color poor, pulse 120, respiration 22. Rattling of mucus in the throat." One hour later the pulse was 160, respiration 38 and "difficulty in breathing. Skin blue." Four hours later the patient was coughing and expectorating mucus and complaining of pain in the chest. The cough and bloody expectoration increased in severity and amount.

	Temp.	Pulse	Resp.
First day after operation	104 (rectal)	140	50
2d & 3d day after operation	102.8 "	130	38
Until 7th day after operation	102 "	102	36
		130	36

After the seventh day the temperature and pulse remained below 100, while the respiration continued between 30 and 24 until the sixteenth day. There was primary union of the abdominal wound. The physical findings: Twenty-four hours after the operation there was moderate dullness over the whole of the right lower lobe. Fine râles and friction rub. Diagnosis: Pneumonia and pleurisy. The leucocyte count was below 16,000, the polymorphonuclears 78 per cent. The sputum was clear with flecks of blood and moderate in amount. The x-ray picture fourteen days after operation showed pleural thickening, unresolved pneumonia and infiltration in the hilum.

In the first two cases we have much the same clinical course and physical findings. Both were clean cases, both had presumably large pelvic veins, due in one case to a very large myomatous uterus and in the other to a tubal pregnancy. In the first case the lung symptoms began about thirty-two hours after the operation, and in the second case a week after unless we may consider that the disturbance of pulse and respiration during operation was caused by an embolus. In both cases the emboli were evidently bland as no inflammatory process resulted in the lung and each case showed later the presence of a thrombus in a femoral vein. The third case was one of acute appendicitis with pus in the lumen of the appendix. There was no spilling of pus during the appendectomy, no symptoms later referable to the abdomen and there was primary union of the wound, but the embolus was evidently infective as an inflammatory process followed immediately. This case did not show a thrombus of the veins of the lower extremity as did the other two, but is classed as an embolus case for the following reasons:

1. The onset of symptoms immediately following the operation.
2. The mild course of the lung symptoms.
3. Bloody sputum.
4. X-ray picture of the lung.

ETIOLOGY

In seeking the etiology of surgical embolism and thrombosis we must look to an alteration in the circulation. More deaths Gibson

says occur from embolism in the first and second twenty-four hours—too rapid for any but an overwhelming infection which is not borne out by autopsy findings. The postoperative lung complications Cutler and Hunt showed were manifest in three-fourths of the cases (76.4 per cent) within forty-eight hours after the operation, again too soon for the incubation period of infection. Virchow believed the cause of thrombosis and embolism lay in an enfeebled circulation and that inflammation of the wall if present was a merely secondary effect. The greatest frequency of embolism and thrombosis is after operations in the lower abdomen. It is after hysterectomy with large fibroids or after pregnancy where continued pressure on the veins of the lower extremities has kept these veins overdistended that thrombosis and embolism most frequently occur and less frequently after pelvic operations on pus tubes or ovarian abscesses where bacteria would furnish abundant cause if it were the chief etiologic factor in embolism. The femoral veins are attached to bone and fascia just above the valves near Poupart's ligament which prevent the veins readily adjusting themselves to a diminished blood volume. Counter currents or an eddying motion of the blood attributed by Aschoff and von Recklinghausen to thrombosis formation may result, aided in the left femoral vein by the greater difficulty in the return flow due to the increased length and obliquity of the left common iliac vein and its passage under the left common iliac artery. A distended sigmoid or rectum favors stasis in the blood stream. The fall in blood pressure which is the usual result in a hysterectomy operation due to loss of blood and injury to ganglia cells causes a sudden diminution in the blood volume of the femoral vein while its fixed attachment prevents it from quickly adjusting itself to the smaller blood stream. Thrombi are both red and white. The red thrombi are formed from stagnating blood and resemble a clot in shed blood. The white thrombi are formed from circulating blood and consist chiefly of altered blood platelets, polynuclear leucocytes, fibrillated fibrin in large amounts with a varying number of red corpuscles. It is considered that impairment to the nutrition cells of the vascular wall is necessary for the formation of white thrombi, and that this occurs very quickly when there is a diminution in the volume of the blood stream. The large veins of the pelvis, the slowing down of the blood stream, the diminished volume with consequent loss of nutrition to the vessel walls, combined with the character of an operation whose severity is often lost sight of in the usual smooth convalescence but which from the injury to ganglia cells produces the condition we term shock favors thrombosis formation.

While sepsis may be the source of emboli it would not seem that it plays as great a rôle as circulatory disturbances in pulmonary throm-

bosis and embolism, as the temperature is usually only moderately elevated, the leucocytosis not marked and the condition usually soon recovered from.

A thrombus has been likened to a serpent in appearance. Its head is the white thrombus, its neck gray and the tail, which is formed last, is red. But unlike the serpent it is the tail which carries the venom, for when the tail is sufficiently long to reach the middle of the blood stream its head is still held fast to the wall of the vessel, but the soft red clot at the tip of the tail is easily broken off and swept away by any sudden increase in the rate of flow, or by pressure on the vessel wall, either of which may occur on the first sitting up or getting out of bed, etc.

Hampton and Wharton report that in their autopsy records 85 per cent of the fatal pulmonary embolism cases had their origin in an embolus from the pelvic veins and that it seems probable that traumatic and mechanical factors play a larger part in the formation of pelvic thrombosis than infection does.

The anemia which is often present, due to menorrhagia or metrorrhagia, may contribute to a lowered resistance and also to the "myoma heart" which in itself may be a cause of venous thrombosis as almost any heart lesion producing myocardial insufficiency may be associated with thrombosis.

REVIEW OF OPERATIONS IN THE WOMAN'S HOSPITAL

In accordance with this theory it has been of interest to review 130 cases operated upon for myomata uteri by Dr. Ward or myself in the Woman's Hospital from March 1, 1918, to March 1, 1920.

In these two years all ward patients having large fibroids necessitating removal were kept in bed from five to seven days previous to operation, and no embolism or thrombosis occurred in any case. In the private patients who were not kept in bed previous to the operation, but usually operated upon the day after entrance to the hospital, a fatal embolus occurred once and venous thrombosis six times with exactly the same technic employed for both classes of cases, except that the ward patients had been kept in bed previous to the operation.

In the past year blood pressure was maintained by glucose and gum acacia given intravenously throughout a series of approximately 250 operations. The series included hysterectomies for myomata uteri and in no case in the whole series did embolism or thrombosis occur. While in other cases done by the same two operators without maintaining blood pressure or preliminary rest in bed, embolism or thrombosis occurred four times.

While it is true the number of cases is too small to draw positive

conclusions from, it is believed that the tonic effect on the heart and blood vessels obtained by relieving the pressure from large tumors in the pelvis has been a factor in the prevention of embolism and the maintenance of blood pressure during operation has materially assisted this.

CONCLUSIONS

1. The most frequent cause of postoperative pulmonary complications following hysterectomy for myomata uteri is pulmonary embolism or thrombosis.

2. The source of pulmonary embolism or thrombosis is a thrombosis of the pelvic veins or the veins of the lower extremities, or a thrombosis of the right heart.

3. Thrombosis of the pelvic veins occurs much more frequently than thrombosis of the lower extremities.

4. The development of a thrombosis or embolism may be during an operation or immediately following it. The most frequent time seems to be in the first forty-eight hours.

5. The symptoms in the order of their most frequent occurrence are pain, friction rub, cough, bloody sputum and râles, dullness and alteration of breath sounds.

6. These signs are premonitory of a thrombosis, but the evidence of thrombosis in the veins of the lower extremities or pelvic veins does not appear until later.

7. The physical findings at the onset are similar to lobar pneumonia or pleurisy but the clinical picture soon separates the cases. In differential diagnosis the x-ray may be of value.

8. Thrombosis and embolism occur more frequently after hysterectomy for large myomata and less frequently after operation on pus tubes and ovarian abscesses.

9. The causes are (A) an enfeebled circulation due to: (a) dilated venous trunks, especially of the pelvis and lower extremities; (b) venous stasis; (c) lowered blood volume due to hemorrhage or shock; (d) myocardial insufficiency; (B) infection.

10. The treatment should be prophylactic and directed to improving the circulation of the blood by strengthening the heart muscle and walls of the blood vessels and increasing the hemoglobin of the blood. The importance of rest in bed as a preliminary to operation to relieve the pressure of large myomata on the veins of the pelvis and lower extremities, the use of blood transfusion before operation in cases of marked anemia and the maintenance of the blood volume during operation by gum glucose given intravenously should be emphasized.

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RADIOGRAPHY OF CLOSED FALLOPIAN TUBES*

To Determine the Location of Obstructions

By William T. Kennedy, M.A., M.B. (Tor.)

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THE radiographic study of the uterus and tubes following their extirpation, presented by Sampson,[1] has given us an extremely concrete picture of the blood supply of these organs, and has shown us the danger of intrauterine applications with or without pressure when there is any break in the continuity of the uterine mucosa. Peterson,[2] clearly visualizing the uterus, tubes, and tumors of the pelvis and the abdomen by pneumoperitoneum and radiography, has introduced a classical method of diagnosing pelvic abnormalities. The insufflation of uterus and tubes with carbon dioxide, as done by Rubin,[3] in a small, but quite a laudable number of women who have been sterile because of some tubal obstruction, has rendered them able to become pregnant almost immediately and in practically every case has enabled the surgeon to determine the patency or nonpatency of the tubes. Before the introduction of Rubin's method it was clinically impossible to definitely confirm a diagnosis of occluded tubes and up to the present time the location of a preoperative obstruction has remained entirely to the surgeon when the patient's abdomen was opened, and even he with both tubes before him, has found it difficult to satisfy himself as to the condition of their canals. During an operation little time may be required or much time consumed endeavoring to locate the obstruction. In the end the real occlusion could easily have been overlooked, which difficulty might well account for the more or less discouraging results of salpingostomy performed even by skilled gynecologists. Further, Rubin's method has not lessened the surgeon's task of locating the site of the obstructions in or about the tubes until the patient is on the operating table. This task I shall endeavor to eliminate by presenting a somewhat clear diagnosis of the sites of obstruction before operation. I have been filling the uterus and tubes with a 20 per cent solution of sodium bromide and have been radiographing that part of the genital tract which has received the fluid. The pressure in and the quantity which has passed into the cavity have been noted. The ampulla of the tube

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rendering a shadow must be connected with the uterus by a patent isthmus even though the passage between contains no sodium bromide. If the ampulla of the tube does not appear on the radiograph an obstruction must exist either in the isthmus of the tube or in the cornu of the uterus, or the tube has been previously removed.

APPARATUS

The apparatus used to pass sodium bromide solution into the uterus and tubes and to measure the quantity and pressure of the fluid is shown in the following diagram (Fig. 1).
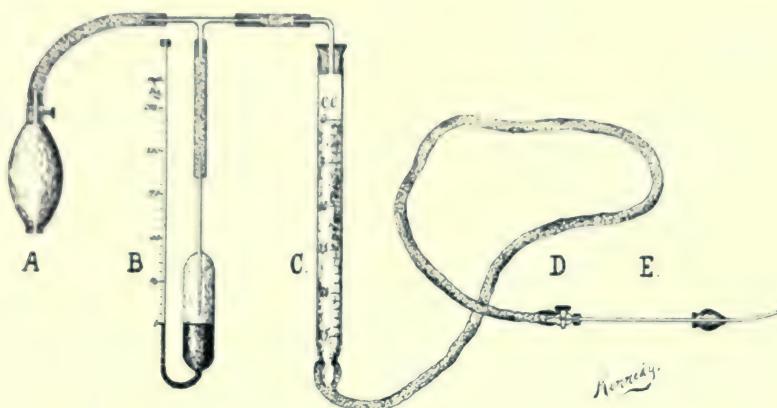
Fig. 1.

A—Compression bulb with release screw which is used to inflate the sleeve band of a sphygmomanometer.
B—Mercury Manometer used with the sphygmomanometer.
C—25 c.c. Burette to measure the Sodium Bromide solution.
D—Tap to control the passage of the solution.
E—Uterine hollow sound with rubber washer (Rubin).

PROCEDURE

The rubber connecting tubes, the sound E. the burette C. the sodium bromide solution, a bivalve vaginal speculum and a double tenaculum are sterilized by boiling.

The apparatus is connected as in Fig. 1 with the sodium bromide solution filling it from zero on the burette to the uterine end of the sound and the tap D is closed until used.

The patient is placed upon a cystoscopic x-ray table for radiographing the pelvis, ureters and kidneys. The Potter-Bucky diaphragm is used. A lead screen is used to protect the surgeon while the radiograph is made. Fig. 2 illustrates this arrangement.

Fig. 3 illustrates the lateral views and the corresponding vertical views of the different angles which the Rubin sound makes with the cavity of the uterus. When one knows the clinical position of the body of the uterus the degree of flexion can be estimated.

The first of a series of 20 patients was radiographed June 14, 1922.

Two cases have been omitted because the radiographs were too faint to permit interpretation.

Of 18 cases herein described one had partially occluded and 17 had occluded tubes as demonstrated by insufflation with CO_2 according to the Rubin method before being radiographed. All patients were seen either one or two weeks following their radiographs, and the patient with partially occluded tubes was seen on two successive weeks. None of these patients gave a history of pelvic symptoms following examination.
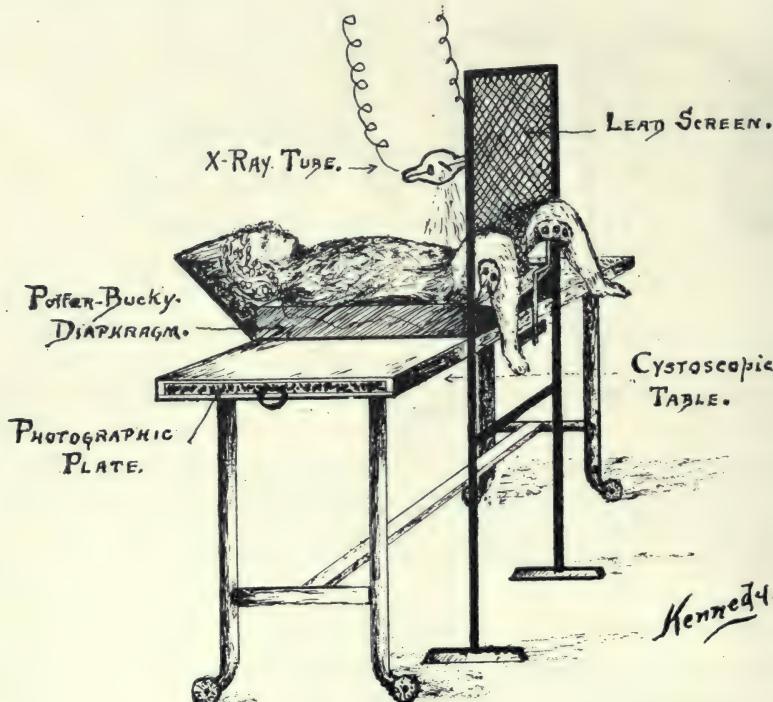
Fig. 2.

The uterus and tubes in the patient with partially occluded tubes (Case 1) cast no shadow. In Case 5 the uterus and tubes cast a shadow at the first examination (radiograph 10); but three weeks later no shadow was obtained with three trials. In Cases 6 and 7 no shadows were obtained. Therefore no sodium bromide passed beyond the internal os. All three cases had anteflexed, retrocessed uteri.

In 15 cases (omitting Cases 1, 6 and 7), of which radiographs are here shown, 4 tubes are known to have been removed at operation, leaving 26 tubes to be considered. Of these 26, 8 do not appear in the radiograph because they are closed at the cornu of the uterus or in the isthmus, and the remaining 18 tubes are closed at or about the

fimbria. The occlusions are relatively 30.8 per cent in the isthmus and 69.2 per cent in or about the fimbria. Of the 18 tubes casting shadows, 11 isthmi cast a shadow but 7 cast no shadow, that is, 18 isthmi allow the passage of sodium bromide solution and 11 or 61.2 per cent cannot contract enough to empty their contents, while 7 or 38.8 per cent can empty their contents in either direction. These
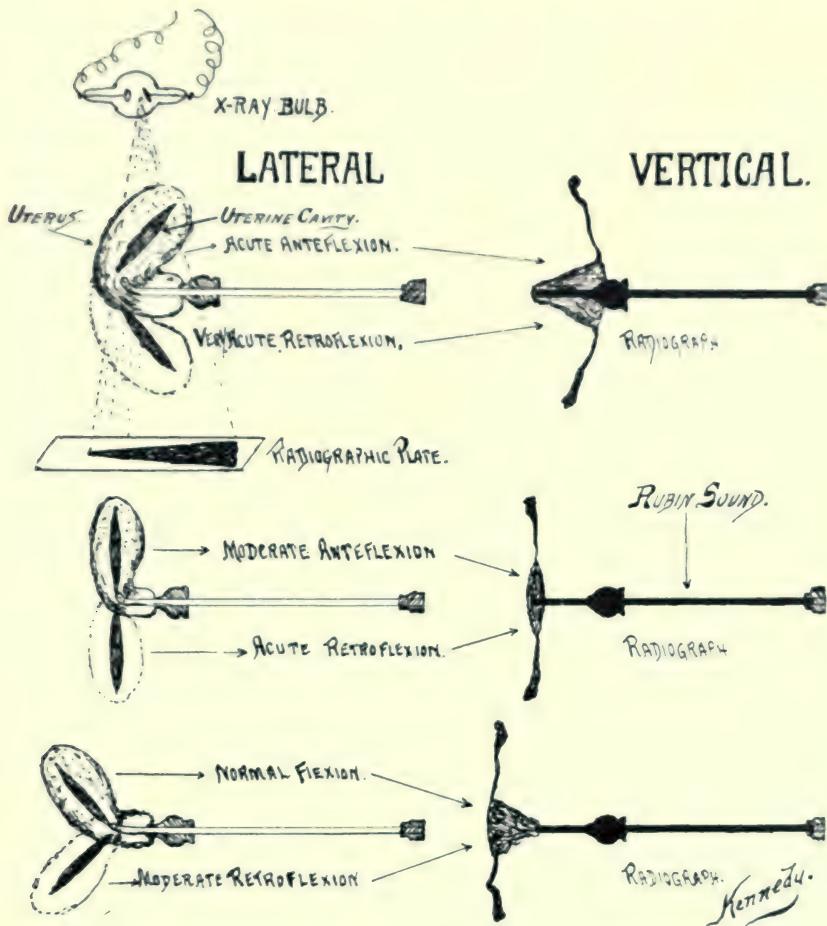
Fig. 3.

percentages are based upon a very small number of cases and may require changing when a larger series has been examined.

Cases 1 to 12 were married for periods varying from one to ten years and have never been pregnant. Cases 13 and 14 each has had an ectopic pregnancy only. Cases 15 to 18 each has had one or more intrauterine pregnancies.

Five cases have been operated upon, one by Dr. Ward, one by Dr. Rawls and three by myself.

Each radiograph has a key in its corner showing the sodium bromide shadows.

CASE 1.—J. M., 26939.—Insufflation with CO_2—rate sufficient to raise the pressure 100 mm. in 20 seconds; first trial maximum pressure 200 mm.; no gas passed through the tubes. Second trial, maximum pressure 180 mm. when the gas began to flow through the tubes and continued at a pressure of 55 mm.; shoulder pains present. Diagnosis: partially occluded; age twenty-four years; married 1½ years; never pregnant. Numerous nonmotile spermatozoa present (unsatisfactory specimen). Uterus first degree retroverted, slight thickening in both adnexae.

Fig. 4.

Radiogram (Fig. 4).— The body of the uterus and the position of the tubes cannot be seen as the musculature of these organs has forced all the sodium bromide solution into the right side of the culdesac.

Diagnosis.—No information except that at least one tube is patent and from the shadows one would expect the right.

Dysmenorrhea which frequently is associated with an anteflexed retrocessed uterus, having a stenosed cervix, would easily be caused by the irritation of the menstrual blood extruded through the tubes into the peritoneal cavity. Further, when any obstruction of the cervix occurs at menstruation, the uterus and tubes can force the menstrual blood and epithelium into the peritoneal cavity, thus easily explaining what Sampson[4] considers a very important factor in the etiology of ovarian hematoma. When the isthmi are open and the fimbriae occluded the menstrual blood would distend the ampullae and cause pain. In acute endocervicitis, occurring about the internal os, when the discharge is rather profuse (gonorrheal) any purulent material escaping into the uterine cavity could easily be forced into the peritoneal cavity, ow-
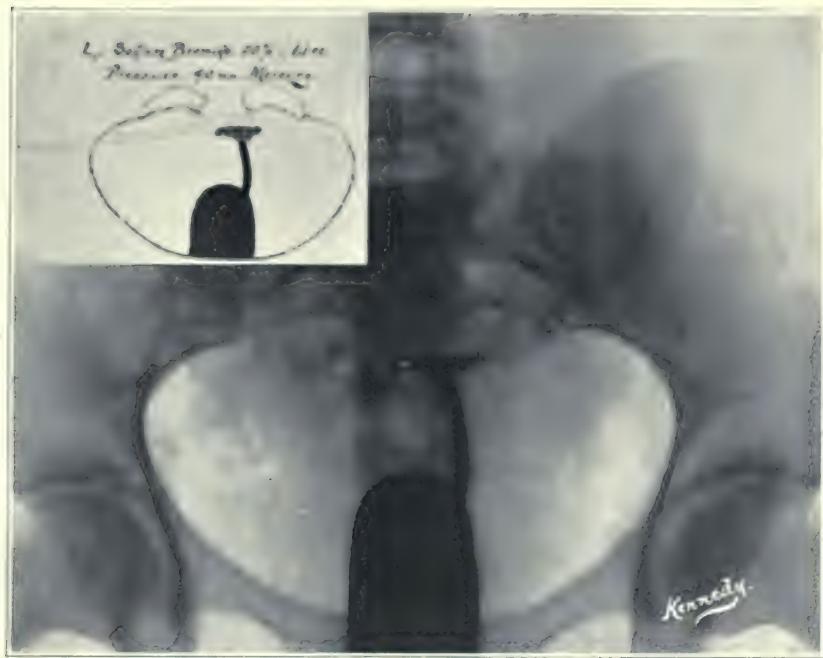
Fig. 5.

Fig. 6.

ing to the inflammatory obstruction of the internal os. This would easily explain the present conjecture that the gonococci enter the peritoneal cavity by passing over the mucosa and not by way of the lymphatics.

CASE 2.—L., No. 26637, occluded, age twenty-two years, married two and one-half years, never pregnant. Spermatozoa present; nonmotile (unsatisfactory specimen). Uterus infantile; adnexae negative.

Radiograms.—Figs, 5, 6, and 7 show the uterine cavity small and the axis of the body of the uterus about at right angles to the cervical canal. When the pressures were 40 mm. and 66 mm. of mercury, no solution appeared in either tube, but when the pressure was raised to 200 mm. of mercury, the left tube became filled with the solution but the right received none.

Diagnosis.—The uterine cavity is very small. Occlusions occur in the isthmus of the right tube and at or in the fimbria of the left. Left hydrosalpinx, small.
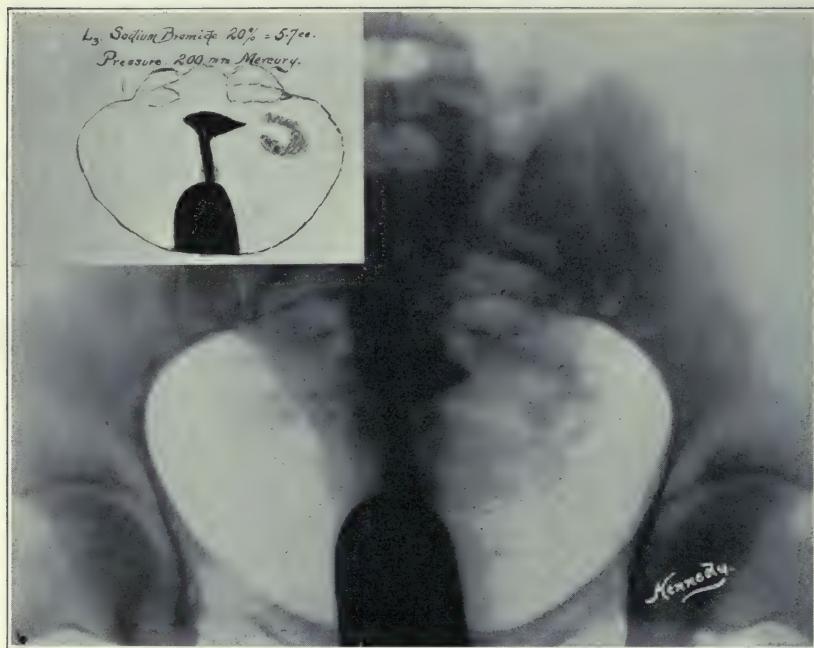
Fig. 7.

CASE 3.—S., No. 26716, occluded, age twenty-eight years; married ten years, never pregnant. Spermatozoa not examined. Uterus small, retrocessed, adnexae negative.

Figs. 8, 9, 10, and 11.—Uterine cavity 4 cm. by 3.5 cm. (medium size)—tubes apparently hang low on the broad ligaments and parallel with the axis of the uterus; hence are prolapsed. Each tube is open at its isthmus. The right tube has a long slender canal and may also have an accessory canal. The left tube is very probably a hydrosalpinx.

Diagnosis.—Left hydrosalpinx. Occlusions occur in both fimbriae.

CASE 4.—F. W., No. 25524, occluded age thirty-five years, married four years, had a dilatation and curettage two years ago—never pregnant. Spermatozoa numerous, nonmotile. (Specimen unsatisfactory.)

Radiogram.—(Fig. 12) Uterus small, no shadow of left tube—low shadow of the right fimbria.

Fig. 8.

Fig. 9.

Diagnosis.—Uterus infantile, left isthmus occluded, right tube prolapsed, right fimbria occluded.

CASE 5.—C. W., No. 26966, occluded, age twenty-seven years, married five years, husband had two children by his first wife; patient was told she had salpingitis eight years ago. Has had a vaginal discharge for two years. Uterus small, anteflexed, retrocessed adnexae negative.

Radiogram.—(Fig. 13.) Uterus small, the axis of the body of the uterus makes an acute angle with the canal of the cervix. No right tube visible. A blurred ampulla of the left tube appears with a small canal leading to the uterine cavity.

Radiogram.—Three weeks later, no shadow.

Diagnosis.—Anteflexion of the uterus; right isthmus occluded, left fimbria occluded.

Operative Diagnosis.—8/8/22. The right tube was closed at its fimbria, the fimbria being turned down and attached to the posterior wall of the broad ligament by a

Fig. 10.

small adhesion. The right isthmus, for a length of about 2 cm., was extremely small and had a core-like canal about 1½ mm. in diameter. The left tube was closed at the fimbria, this fimbria being spread out over an ovarian cyst about 4 cm. in diameter and attached by an adhesion to the posterior wall of the broad ligament. There were a few filmy adhesions from the cervix to the posterior wall of the culdesac but these were not drawing the uterus backward. The uterus was normal in position and the anteflexion was not noted at the operation. It is probable that the uterine musculature may have relaxed under anesthesia allowing the anteflexion to disappear.

CASE 6.—A. G., No. 31197, occluded, age twenty-four years, married four years, never pregnant. Husband not examined. Her complaint was not sterility but painful menstruation for four years.. Uterus anteflexed and retrocessed. At operation 10/16/-22 it was found that the axis of the cervix was inclined about 75 degrees to the axis of the uterus.

Radiogram.—No shadow.

Fig. 11.
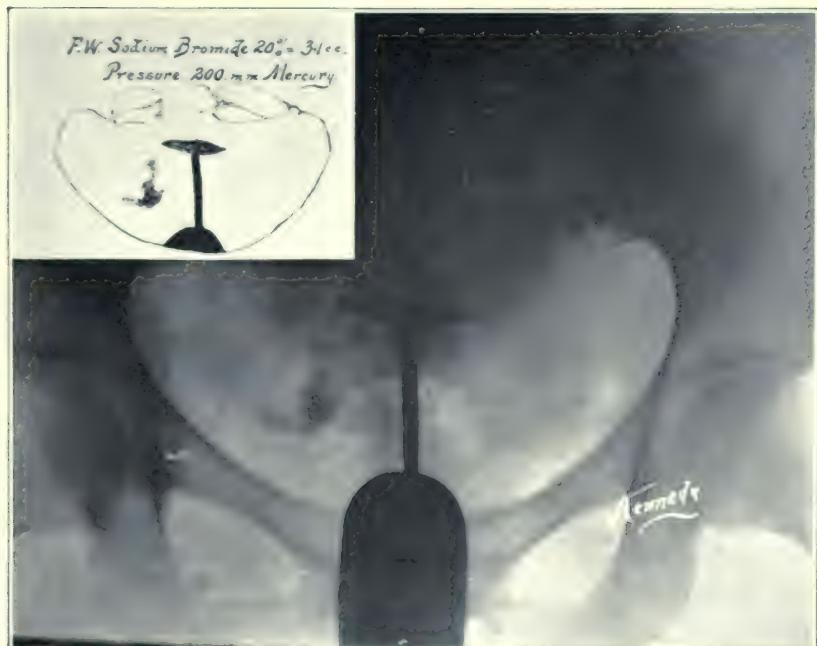
Fig. 12.

CASE 7.—E. T., No. 22637, occluded, age twenty-nine years, married five years, never pregnant. Complaint, sterility. Uterus anteflexed and retrocessed. Operation three years ago; dilatation and curettage with stem pessary inserted.

Radiogram.—No shadow.

CASE 8.—T. N., No. 26969, occluded, age twenty-six years, married six years, spermatozoa not examined. Uterus underdeveloped. Adnexa thickened, left ovary cystic.

Radiogram.—(Fig. 14) Uterus medium size with axis of body at right angles to the axis of the cervix. No shadow of the right tube, shadow for ampulla of the left tube. There is a very long slender canal from the left cornu of the uterus to the fimbria of the tube.

Diagnosis.—Right isthmus occluded; left fimbria occluded. ''Clubbed fimbria'' of the left tube. Constricted canal of the left tube.
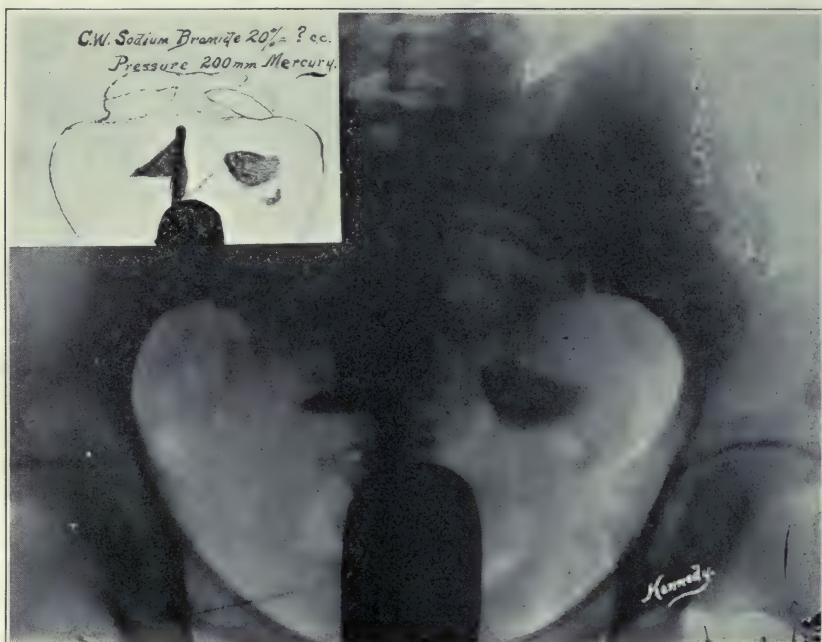
Fig. 13.

CASE 9.—J. R., No. 27521, occluded, age twenty-seven years, married one year, never pregnant. Adherent retroverted uterus, thickened adnexa.

Radiogram.—(Fig. 15.) Uterus retroverted, each ampulla casts a shadow.

Diagnosis.— Retroverted uterus; prolapsed right tube, occlusions occur at both fimbria.

CASE 10.—R. P., Private, occluded, married eight years, never pregnant.

Radiogram.—(Fig. 16.) Uterus small, no tubal shadows.

Diagnosis.—Each tube occluded at its isthmus.

CASE 11.—I. C., No. 27532, occluded, age twenty-five years, married four years, never pregnant. Cervix stenosed. Uterus small and forward. Right appendage negative. Left appendage tender. Left chronic salpingitis with pelvic adhesions. Semen test, three examinations, no spermatozoa found. Prostatic crystals present.

Radiogram.—(Fig. 17.) Uterus medium sized, shadow of uterus at right angles to

Fig. 14.

Fig. 15.
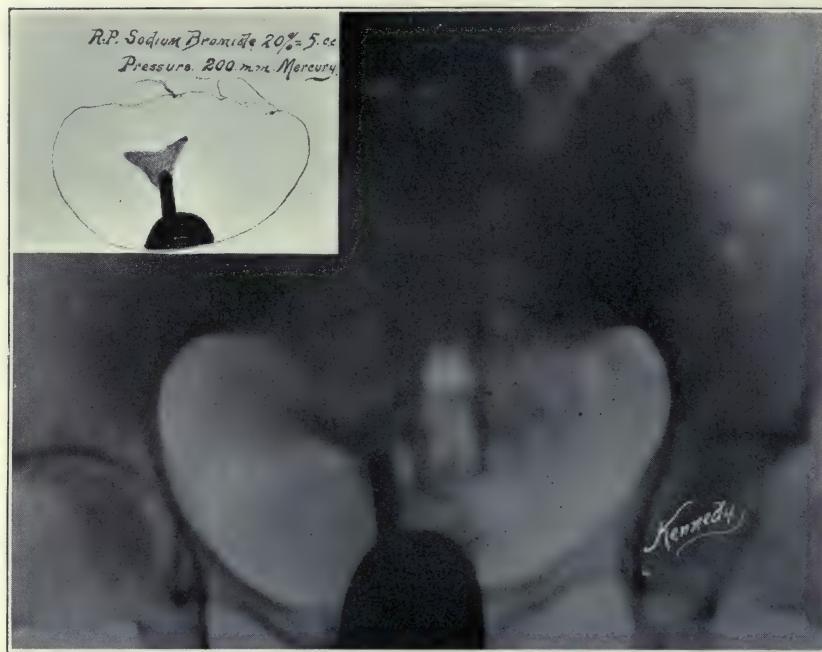
Fig. 16.

Fig. 17.

Fig. 18.

Fig. 19.

the cervix. No ampulla of the right tube visible. Left ampulla and fimbria parallel with the uterus, hence prolapsed, with fimbria in the culdesac near the pelvic wall. Sodium bromide in vagina.

Diagnosis.—Moderately anteflexed uterus, right isthmus occluded, left isthmus patent. Left tube prolapsed in culdesac. Fimbria spread out, occluded and adherent.

CASE 12.—M. I., No. 31428, occluded, age thirty-one years, married 10 years, never pregnant. Complaint sterility and pain in lower abdomen for ten years. D. and C. ten years ago. Semen, normal number of spermatozoa with slight motility. Bilateral chronic salpingitis; fibroma uteri; anteflexed uterus.

Radiogram.—(Fig. 18) Uterus moderately anteflexed, both tubes parallel to the uterus, right ampulla showing but right isthmus distinctly absent. Left ampulla and
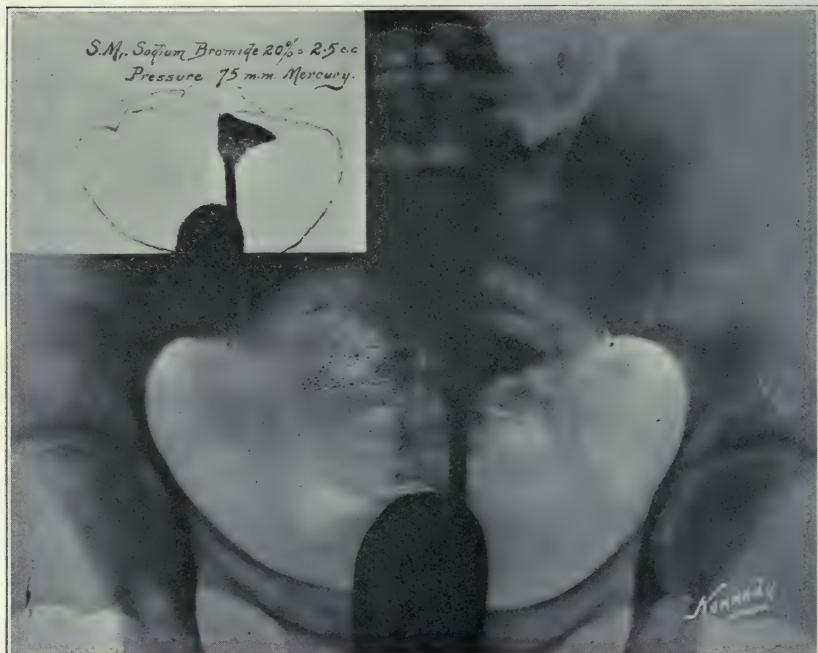
Fig. 20.

left isthmus both showing. Right tube larger than left and nearer its respective pelvic wall. Depression on inner uterine wall about one third of the way from the internal os to the right cornu.

Diagnosis.—Moderate anteflexion of the uterus. Right tube prolapsed, closed at fimbria and clubbed. Not a hydrosalpinx. Left tube closed at fimbria and more adherent in the culdesac, not a hydrosalpinx.

Operative Findings.—Nov. 23, 1922. Dr. Rawls. Both tubes were dilated for their outer seven eighths and were buried by adhesions with the ovaries in the culdesac, which adhesions also closed their fimbriated ends. Both ovaries were normal. Just above the internal os on the anterior right surface of the uterus, was a small fibroid, and a similar one on the left posterior surface of the uterus near the horn. There was no stenosis of the cervix although it was rather short in length with the uterus anteflexed upon it.
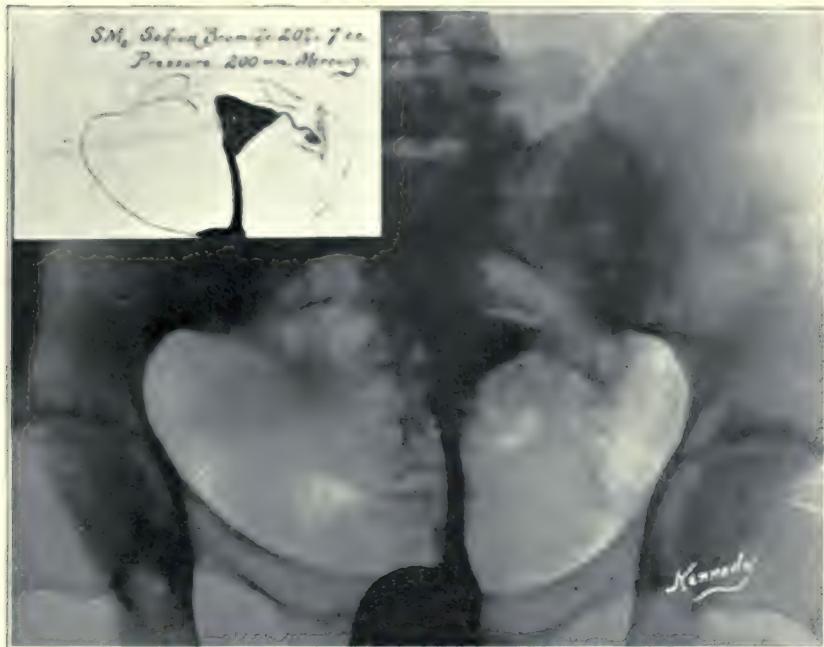
Fig. 21.
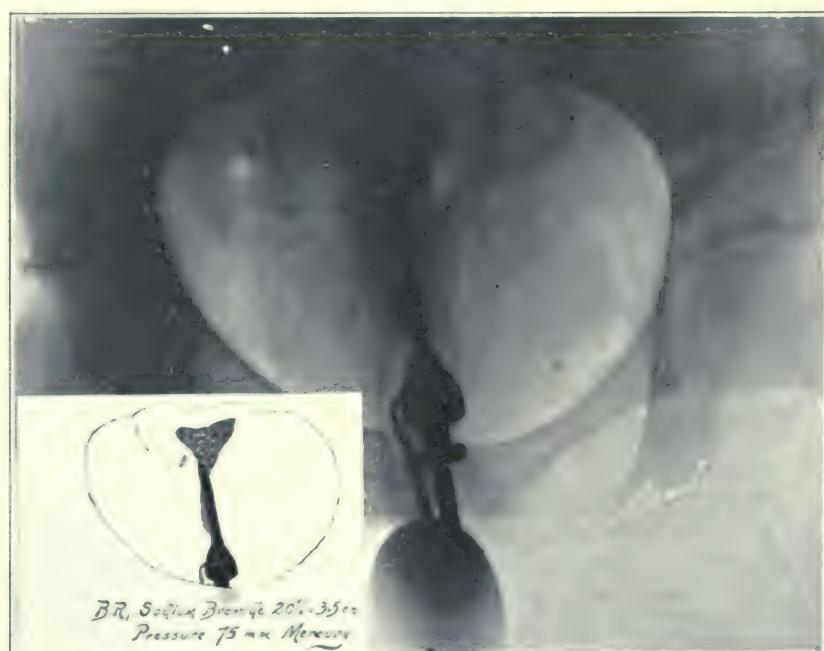
Fig. 22.

CASE 13.—Private, occluded, age thirty-eight years, married seventeen years. Had an ectopic pregnancy in the right tube thirteen years ago. Tube removed by operation, uterus retroverted, adnexa negative.

Radiogram.—(Fig. 19.) Uterus small, retroverted, no shadow of the right tube, left tube very small with a closed fimbria.

Diagnosis.—Retroverted uterus, right isthmus closed (tube resected). Left tube probably rudimentary in character with a clubbed closed fimbria (small hydrosalpinx).

CASE 14.—S. M., No. 27109, occluded, age thirty-four years, married two years. Right ectopic pregnancy one and one-half years ago. Tube removed by operation. Pelvis negative.

Radiograms.—(Figs. 20 and 21.) Uterine cavity apparently in the same straight
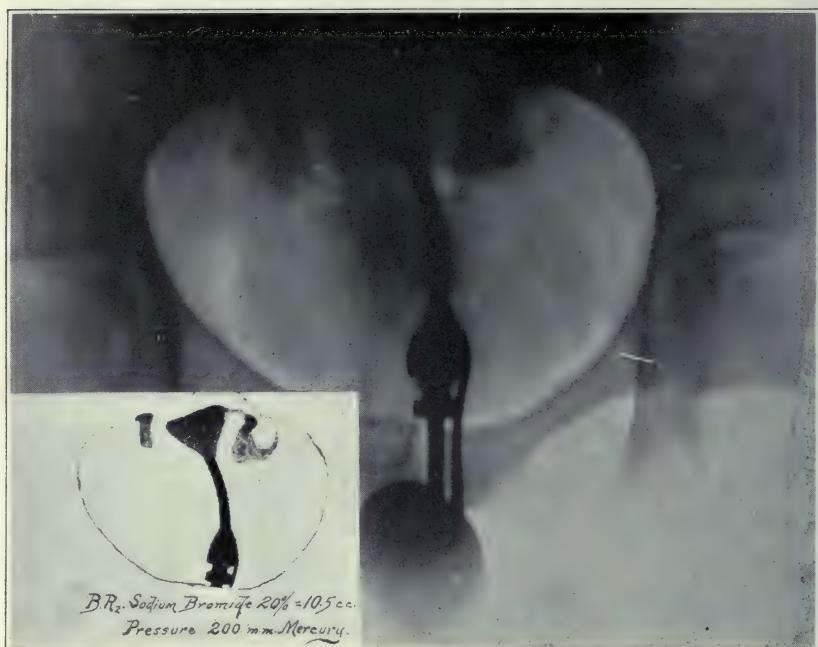
Fig. 23.

line as the cervical canal. Medium sized cavity, no shadow of the right tube. Shadows show a rudimentary left tube with its fimbria closed.

Diagnosis.—Right tube absent, left tube rudimentary and closed at its fimbria.

CASE 15.—B. R., No. 308-49, occluded, age thirty-three years, married five years; one pregnancy three years after marriage which ended in a spontaneous abortion at four months. Was a widow one year. Re-married and has been living with second husband for five years. No further pregnancy. No spermatozoa examination as husband did not so desire. Uterus indefinite. Both adnexa thickened.

Radiograms.—(Figs. 22 and 23.) Uterus normal position, medium size. There are shadows of the ampullae of both tubes. Tubes are parallel with the axis of the body of the uterus, hence they are on the posterior wall of the broad ligament, prolapsed and clubbed, neither is a hydrosalpinx.

Diagnosis.—Both tubes prolapsed and both fimbria closed.

Operative Diagnosis.—Aug. 4, 1922. Uterus was forward in position and normal

Fig. 24.

Fig. 25.

in size. Each tube was club-shaped, occluded at its fimbria and fastened to the posterior wall of the broad ligament near its pelvic extremity by rather firm adhesions. The peritoneum immediately posterior to the uterus was entirely free from adhesions. Both ovaries were normal.

CASE 16.—F. B., No. 266669, occluded, age thirty-six years, married ten years. Dilatation and curettage eight years ago. One spontaneous abortion seven years ago. One full term pregnancy six years ago. Uterus retroverted and retrocessed. Right ovary prolapsed and tender. Left adnexa thickened.

Radiogram.—(Fig. 24.) Uterus appears retroverted, right tube casts a shadow reaching out to the pelvic wall. Left tube shows a shadow near the uterus parallel with the uterine axis in its proximal portion, then turns laterally towards the pelvic wall.

Fig. 26.

Diagnosis.—Tubal canal small, each tube occluded at its fimbria, left tube prolapsed.

CASE 17, E. L. No. 27524, occluded, age thirty-two years, married twelve years, two children eleven and ten years of age. Abdominal operation eight years ago. Cervix amputated but still slightly eroded and hypertrophied. Uterus enlarged.

Radiograms.—(Figs. 25 and 26.) Uterus normal in position, large, no shadow of either tube appears.

Diagnosis.—Bilateral salpingectomy has been done.

CASE 18.—C. D., No. 31479. Age twenty-nine years, married thirteen years; became pregnant one month after marriage but lost this pregnancy at seven months and has never been pregnant since. Husband died. Patient was widow then for one year and has been married again for two years.

Radiogram.—(Fig. 27.) Uterus moderately large and in position, no shadow of

right tube visible; shadow of isthmus and ampulla of the left tube with distal portion of the shadow faint, because the sodium bromide solution was diluted.

Diagnosis.—Uterus normal in position, cavity large, right isthmus occluded, left tube has a small hydrosalpinx at its distal end and is occluded at the fimbria. This tube is prolapsed and lies toward the pelvic wall.

Operative Findings.—Nov. 28, 1922. Dr. Ward. Both adnexa were buried in adhesions. Left tube converted into a small hydrosalpinx, containing clear serum-like fluid, was behind the uterus. Right tube had a small nodosum at the uterine horn, was chronically diseased and closed.

Fig. 27.

CONCLUSIONS

1. In view of Sampson's work no radiogram should be made in any case where there is evidence of bleeding.

2. The degree of flexion of the body of the uterus can be determined if one knows the position of the uterus.

3. The internal os can withstand a pressure of 200 mm. of mercury in the cervical canal without its musculature allowing the passage of any solution into the uterine cavity.

4. That many isthmi, while permitting the sodium bromide solution to pass through their canals can overcome a pressure of 200 mm. of mercury and expel their contents in either direction.

5. That 30.8 per cent of the tubes examined were occluded at the isthmus and 69.2 per cent were occluded at the fimbria. Of the

tubes casting a shadow 61.2 per cent of the isthmi appear and 38.3 per cent do not appear.

6. That a radiogram obtained according to the above method, when one tube is, or both tubes are, patent or partially occluded is,

   a. That probably only one tube is open, in which case practically all the sodium bromide would be seen in that side of the pelvis.

   b. That when the cervix is tightly closed the uterus and tube (or tubes) completely empty their fluid contents into the peritoneal cavity.

7. That the surgeon is able to determine the following points before opening the abdomen:

   a. The length, breadth, position and direction of the canal of any tube casting a shadow.

   b. The exact site of the occlusion, whether at the fimbria or in the isthmus.

   c. Whether a tube, open at its isthmus and closed at its fimbria is empty and simply clubbed, or is filled with fluid, such as hydro- or hematosalpinx.

   d. Whether an operation to overcome the obstruction and thus remove the sterility might hopefully be done when at least one isthmus is open, or might be almost useless when both isthmi are closed.

8. That a study of the sterile woman having no active cervical or tubal involvement should be initiated with carbon-dioxide insufflation (Rubin). If an occlusion is determined, the uterus and tubes should be radiographed as herein described to determine the points of occlusion, and provided the husband is normal, a salpingostomy may be done with some hope of success, if the occlusion is at the fimbriated end of the tube.

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REPORT OF CASES OF MALIGNANT GROWTHS OF THE BLADDER TREATED BY RESECTION AND RADIUM*

By Henry G. Bugbee, M.D., F.A.C.S.

Urologist

WITH the discovery by Beer that benign papillomata could be destroyed by fulguration, it was hoped that malignant growths could be eliminated by the same or similar methods, the dealing with such tumors by surgery alone having been unsatisfactory in many cases.

Fulguration proved to be of little benefit and often a menace in dealing with malignant tumors of the bladder. It caused slight destruction of tissue in some cases, stimulated others in their growth, and led to infection, while valuable time was lost to other methods, which might have proved beneficial.

Diathermy and x-rays were given a trial, with slight success, and were abandoned, to be resurrected again during the past few years, the latter in the form of more powerful machines with deeper penetration. This work is still highly experimental. We will await clinical reports with interest and hope.

Radium was taken up as an agent of destruction of malignant bladder tumors. It was first applied, through variously modified cystoscopes, directly to the tumor. In but few cases was this method of treatment satisfactory. We were not sure of the pathology or extent of the growth we were treating. The application was on the surface, was of short duration, and caused discomfort at the time of application. Bladder irritability was often increased. These cases, however, showed that there was some effect upon the tumor which was beneficial.

In glancing over the report of Gardner (1), a collection of 1702 cases of bladder tumor treated by operation at the hands of various surgeons, one is impressed with the almost uniformly fatal results within from one to two years in cases treated by operation only.

A combination of radium and surgery was the next step, and the question now before us is just how valuable an accessory to surgery radium will prove to be in these cases.

In my own experience of the past two years, embracing but 19 cases, all treated by suprapubic cystotomy—in 2, the extensive infiltrating carcinoma largely destroyed by actual cautery and the base treated with radium; others treated by resection only; several by
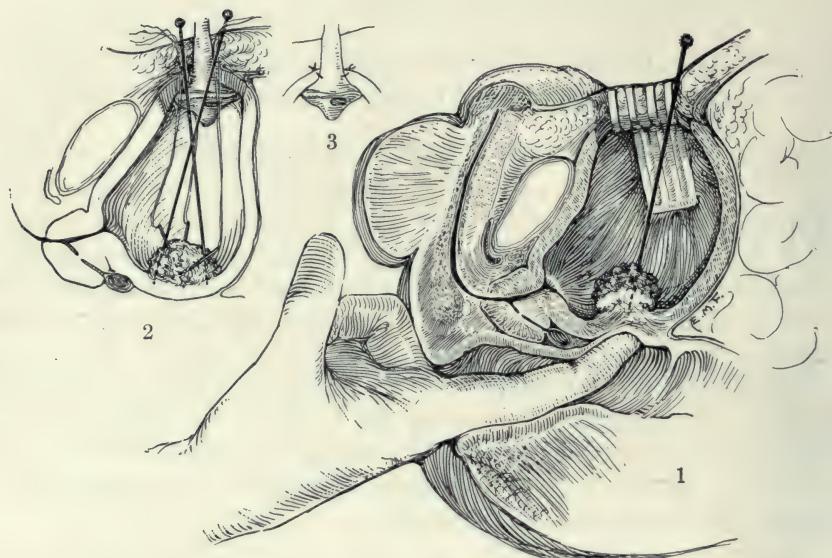
Fig. 1.—Method of introducing radium needles into bladder growth through suprapubic opening.

Fig. 2.—Radium needles in position. Wound closed about drainage tube.

Fig. 3.—Drainage tube sutured in position to prevent displacement upon withdrawal of radium needles.
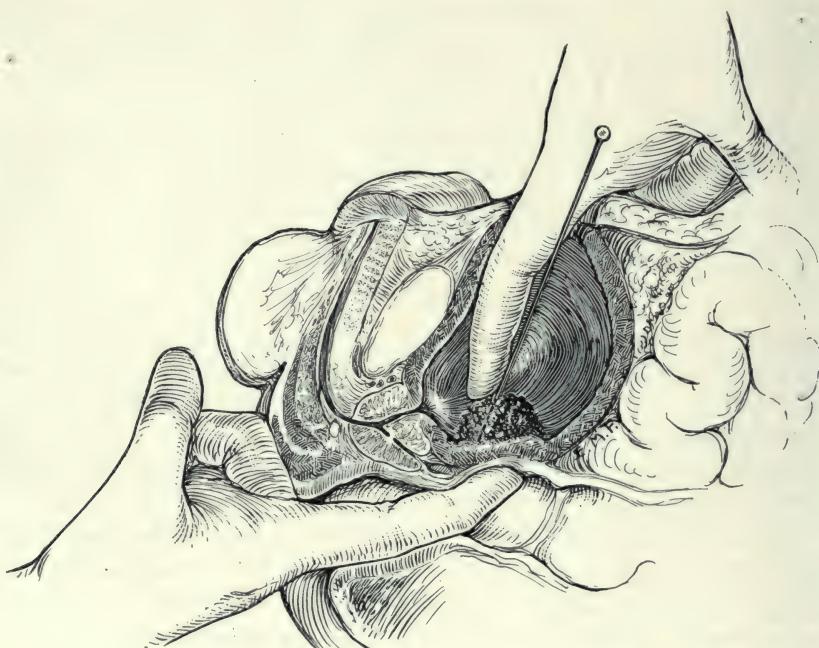
Fig. 4.—Method of reintroduction of radium needles through suprapubic fistula.
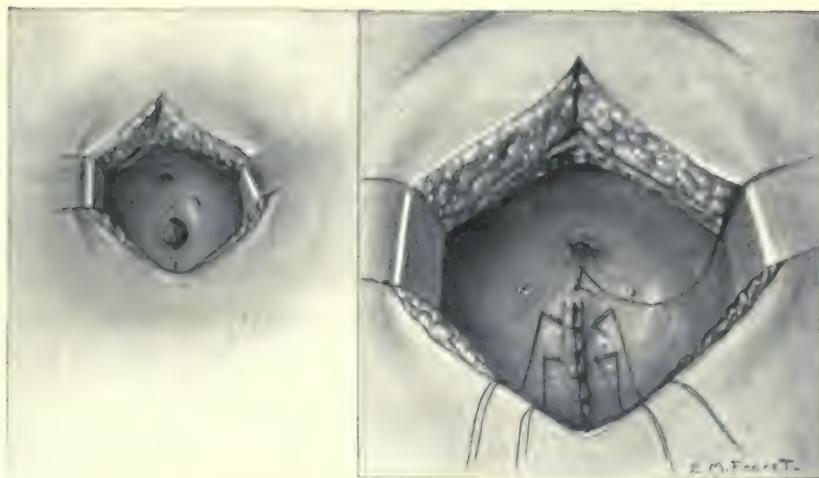
Fig. 5.   Fig. 6.

Fig. 5.—Case 15. Carcinoma of the base of bladder.
Fig. 6. Case 15. Radium needles inserted about line of resection.
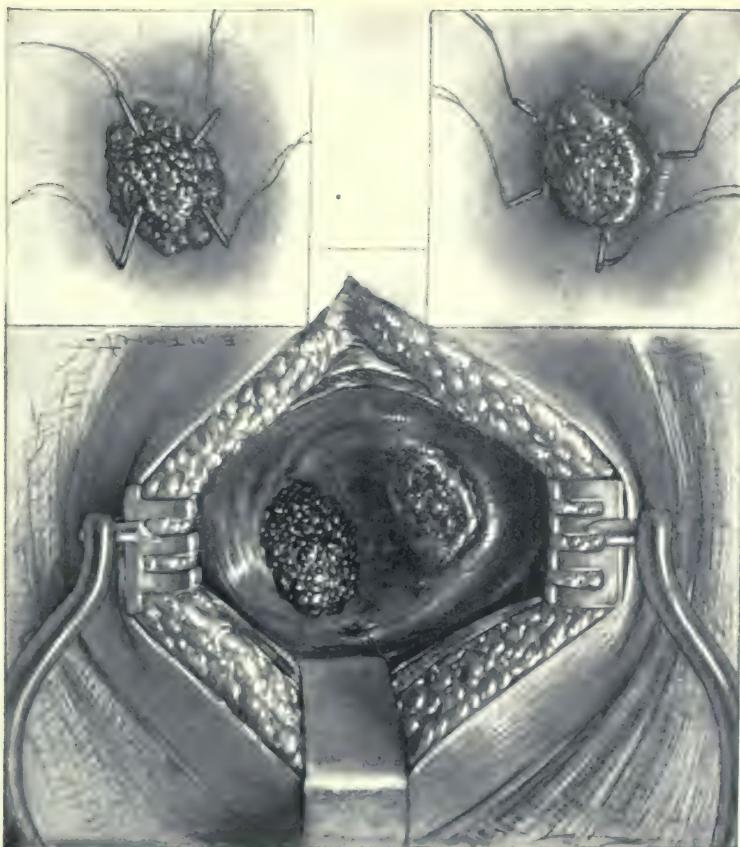
Fig. 7.—Case 19. Two infiltrating growths of bladder base. Insert shows radium needles in position.

TABLE I

NUM-BER	PA-TIENT	DATE	SEX	AGE	SYMPTOMS	HEMATURIA	LOSS OF WEIGHT	CLASSIFICATION OF TUMOR
							pounds	
1	A. C.	4/20/20	M.	41	Frequency, urgency, painful urination for 9 months	9 months	15	Diffuse, infiltrating carcinoma involving base and vesical neck
2	H. L.	7/ 1/20	F.	52	Frequency of urination	7 months	18	Infiltrating carcinoma of fundus of bladder
3	J. K.	7/ 1/20	M.	51	Frequency, urgency, painful urination for 7 months	7 months	10	Infiltrating carcinoma of bladder wall about bladder neck
4	J. M.	7/12/20	M.	63	Frequency of urination	2 months	18	Infiltrating carcinoma of anterior bladder wall
5	A. S.	9/ 7/20	M.	68	Frequency of urination	2 weeks	5	Papillary growth in fundus of bladder
6	F. B.	9/13/20	M.	44	Frequent painful urination for 2 years	2 years	20	Diffuse infiltrating carcinoma of base and vesical neck
7	A. R.	9/24/20	F.	54	Frequency, urgency, for 3 months. Cancer of breast removed five years previously	3 months	10	Infiltrating carcinoma of fundus of bladder
8	G. M.	12/29/20	M.	56	Urgent, frequent, painful urination for 2 years	Intermittent for 8 months	5	Infiltrating carcinoma of base of bladder and trigone. Individual nodules

OPERATION	RADIUM	SPECIMEN	RESULTS
Suprapubic cystotomy. Destruction of growth to serous coat of bladder with cautery	100 mil. applied to base of growth through suprapubic wound for 6000 mil. hours. Endovesical applications for 450 mil. hours. Per rectum 600 mil. hours	Carcinoma	Wound healed. Died of general metastasis 9 months after operation
Wide resection of bladder	None	Carcinoma	Wound healed. Free for 4 months. Recurrence extensive. General metastasis. Died 7 months later
Suprapubic cystotomy. Radium. Second suprapubic cystotomy 10 months later	Radium needles inserted into 4 nodules, 12½ mil. each. Endovesical applications, also rectal applications. Needles again inserted into recurrences at second operation	Adenocarcinoma	Wound healed. Bladder irritability persisted. 4 months after second operation general metastasis. Died
Wide resection of bladder wall	Radium packs, 400 mil. for 24 hours, 3 packs	Carcinoma	Wound healed readily. Implant in scar disappeared after first pack. Well. Free from recurrence. Patient well, 3/15/22
No response to fulguration. Resection of bladder. Radium needles	3 needles about line of resection of pedicle, 3 hours	Early malignancy	Wound healed readily. Free from recurrence today. Patient well, 3/15/22
Suprapubic cystotomy. Destruction of growth to serous coat of the bladder with cautery	Radium applied to base of growth through suprapubic wound, endovesically, and per rectum, 4800 mil. hours, 600 mil. hours, 800 mil. hours, respectively	Carcinoma	Wound healed. Bladder irritability persisted. Recurrence in bladder. General metastasis and death in 9 months
Suprapubic cystotomy. Radium	3 radium needles, 12½ mil. each, inserted into growth (4 hours). Nodule, 1½ cm. in diameter, after surface applications through cystoscope. 5/17/21, reappeared and needles inserted (4 hours)	No section removed. Typical infiltrating cancer	2/19/22. Bladder reopened for supposed recurrence. Incrustation found at site of former growth. Bladder free of growth. Patient well, 3/15/22
Suprapubic cystotomy. Radium	10 radium needles, 2 of 25 mil., 4 of 12½ mil., and 4 of 10 mil., each inserted into nodules (4 hours). Recurrence, bladder reopened and 4 needles inserted into nodules (3 hours)	Carcinoma	Wound healed. Bladder irritability persisted. Recurrence. Bladder reopened one year later. General metastasis

TABLE I—Cont'd

NUM-BER	PA-TIENT	DATE	SEX	AGE	SYMPTOMS	HEMATURIA	LOSS OF WEIGHT	CLASSIFICATION OF TUMOR
							pounds	
9	G. S.	1/1/21	M.	84	Frequency for 1 year	1 year	15	Infiltrating carcinoma of base of bladder
10	H. S.	1/24/21	M.	74	Frequency and urgency for 2 years	2 years	25	Infiltrating carcinoma of entire bladder base and right lateral wall
11	J. D.	7/10/21	M.	50	Frequency, urgency	1 year	15	Papillary growth infiltrating bladder about vesical neck and involving left lateral wall
12	S. S.	7/26/21	M.	74	Frequency, urgency	2 years	10	Large infiltrated carcinoma of left lateral wall and base of bladder
13	D. R.	7/26/21	M.	44	Frequency	9 months	5	Papilloma attached to trigone close to right ureter
14	S. D.	9/12/21	F.	61	None	9 months	10	Malignant papilloma
15	E. R.	9/17/21	F.	58	None	7 months	none	Infiltrating carcinoma
16	J. W.	11/11/21	M.	65	Frequency	2 weeks	none	Malignant papilloma

OPERATION	RADIUM	SPECIMEN	RESULTS
Suprapubic cystotomy. Radium	3 radium needles, 12½ mil, each, inserted into growth. Repeated one month later (4 hours). On three repeated examinations no growth visible or palpable	Carcinoma	Patient died of pneumonia 1 year later. Bladder removed and found free of growth. 2/15/22
Suprapubic cystotomy. Radium	8 radium needles inserted into bladder base (6 hours), 2 of 25 mil., 4 of 12½ mil., 2 of 10 mil., 4 needles inserted through suprapubic wound, 1 month apart for 3 applications; 3 needles for 2 applications 2 months apart, and 1 of 2 needles	Carcinoma	No hard growth palpable. Bladder base edematous. Wound healed. Partial incontinence. 3/15/22
Suprapubic cystotomy. Radium	12 radium needles inserted, 2 of 25 mil., 4 of 12½ mil., 2 of 7 mil., for 6 hours	Adenocarcinoma	Wound healed. Free from growth by inspection and intravesical palpation 6 months later. Patient well. Free from growth. 4/19/22
Suprapubic cystotomy. Radium	10 radium needles inserted, 2 of 25 mil., 4 of 12½ mil., and 4 of 10 mil., for 6 hours	Carcinoma	Bladder free of growth. Patient well. Wound healed. 4/15/22
Vesical papilloma responded at once to fulguration. Suprapubic cystotomy 9 months later	2 radium needles of 25 mil. inserted through bladder base into perivesical growth	Carcinoma	Treated by fulguration 4/9/21. Rapid disappearance of growth. Occlusion of right ureter. Right nephrectomy. Suprapubic cystotomy. No bladder growth. Rapid perivesical growth of carcinoma and death from metastasis
No response to fulguration. Resection of bladder. Radium	4 radium needles, 10 mil. each, inserted about line of resection for 4 hours	Early malignancy	Wound healed. No recurrence to date. Slough in needle wound for 3 months. Patient well, free of growth. 4/18/22
Resection of bladder. Radium	4 radium needles of 12½ mil. each, inserted about line of resection of growth for 5 hours	Carcinoma	Wound healed. No recurrence to date. Slough in needle wounds for 4 months. Free of growth 3/16/22
Resection of bladder. Radium	3 radium needles of 10 mil. each, inserted about line of resection for 4 hours	Carcinoma	Wound healed. No recurrence to date. 4/10/22

TABLE I— CONT'D

NUM-BER	PA-TIENT	DATE	SEX	AGE	SYMPTOMS	HEMATURIA	LOSS OF WEIGHT	CLASSIFICATION OF TUMOR
							pounds	
17	M. Y.	1/27/22	M.	48	Frequency, urgency	15 months	5	Malignant papilloma
18	C. R.	1/31/22	M.	52	Frequency, urgency	2 years	10	Infiltrating carcinoma, entire base
19	S. O.	2/10/22	F.	63	Frequency, urgency	15 months	15	Infiltrating carcinoma, extensive, 2 growths

radium without resection, and the majority by resection and radium—certain points have been impressed upon me which seem worthy of report.

Of these 19 patients, 14 were males, 5 females. Their ages were forty to fifty, 4; fifty to sixty, 7; sixty to seventy, 5; seventy to eighty, 2; eighty to ninety, 1.

All of the patients had hematuria, the duration of which varied from two weeks to two years. They were free from urinary symptoms—urgency, frequency, painful urination—or these symptoms were distressing.

But 2 patients had maintained their weight; the others had lost from 5 to 25 pounds, the average being a loss of 15 pounds in six months.

Six of the cases presented a papillomatous growth; 13 an infiltrating growth unquestionably cancer from the cystoscopic picture. In 4 of the papillomatous growths, where a possibility of its being benign was entertained, fulguration was first attempted, in each case the growth showing no response. All of the 19 cases proved to be malignant.

The test of fulguration upon a papilloma is often valuable in establishing a diagnosis. If a papilloma does not respond to fulguration at once it is probably malignant, and the bladder should be opened without delay. The histological study of the pathology of the growths has been interesting. Where doubt existed as to the nature of the growth removed, or sections taken for diagnosis, the same section or sections from different parts of the growth have been submitted to more than one pathologist. In several instances one pathologist has reported no malignancy while another, in the same case, has reported carcinoma. This means either a different classification of bladder

OPERATION	RADIUM	SPECIMEN	RESULTS
No response to fulguration. Resection of bladder. Radium	4 radium needles of 10 mil. each inserted about line of resection for 3 hours	Early malignancy	Wound healed. No recurrence. Sloughs about needle wounds still present (3 months) 4/16/22
Suprapubic cystotomy. Radium	6 radium needles, 1 of 25 mil., 2 of 12½ mil., and 3 of 10 mil., inserted into the growths	Carcinoma	Drainage tube in position. Growths markedly diminished in size. 4/10/22
Suprapubic cystotomy. Radium	8 radium needles, 2 of 12½ mil., 4 of 10 mil., and 2 of 7 mil., inserted into the two infiltrating growths	Carcinoma	Drainage tube in position. Growths diminishing rapidly 4/19/22

tumors by individual pathologists, or malignancy in isolated areas of the growth.

The accompanying chart gives the important points in these cases.

TO SUMMARIZE THESE CASES

The two cases treated by suprapubic cystotomy, actual cautery destruction of growth, and radium (Cases 1 and 6) were hopeless cases from the start. The growth was very extensive, and there were signs of metastasis. Both men were young, forty-one and forty-four years of age, and it was an attempt to do something for their relief, the symptoms being most distressing.

The female with the infiltrating carcinoma (Case 2) of the fundus of the bladder, was in perfect health for four months after operation when, within three weeks' time, a very extensive recurrence appeared in the bladder and abdominal scar, although the resection had been a wide one, with 2 cm. of healthy bladder on every side of the growth. She rapidly developed metastasis.

Case 3 presented small indurated nodules which proved to be adenocarcinoma. Although the nodules disappeared readily under the radium, others appeared and the growth metastasized rapidly.

Case 13 was a benign papilloma with a malignant base. The intravesical portion of the growth disappeared rapidly under fulguration, while the base extended along the outer bladder wall, completely surrounding the bladder, occluding the right ureter, and appearing in the anterior abdominal wall.* Metastases developed rapidly.

In Case 4, the growth, a large infiltrating cancer of the anterior bladder wall, was eliminated by resection and the implant destroyed readily by radium pack.

In Cases 7, 9, 10, 11 and 12, of infiltrating carcinoma, the bladder

was freed of growth by destroying the growth with radium needles, in the first three, repeated introductions being necessary. In Cases 18 and 19, recent cases, the growths are rapidly receding.

In Case 8, isolated infiltrating growths recurred and metastases have been present for one year.

In Case 15, infiltrating carcinoma treated by resection and radium, needles being inserted about the line of suture, the bladder has been free of recurrence for seven months. The histologic sections in this case showed a rapidly growing carcinoma, strains of cancer cells extending along the muscle bundles.

In Cases 5, 14, 16 and 17, malignant papillomata, resection supplemented by radium needles about the line of resection, has given in each case a bladder free of growth to date.

SUMMARY

In cases of extensive carcinoma of the bladder, when metastasis has taken place, one's efforts should be directed toward making the patient as comfortable as possible. Often this may best be attained by simple bladder drainage.

In extensive carcinoma of the bladder without metastasis, in lieu of total or subtotal cystectomy, it is possible in some cases to destroy the growth by repeated insertions of radium needles—*if* one bears in mind that he is trying to destroy the growth, not the patient, *by not too massive* a dose, but by repeated insertions at sufficient intervals, giving free bladder drainage to allow for sloughing and infection, every effort being exerted during the process to increase body elimination.

A circumscribed carcinoma should be removed by resection, if possible. Recurrences after operation are less resistant than the primary growth, sometimes yielding even to fulguration. A careful watch of all cases following operation, should be maintained that recurrences may be detected as early as possible, and destroyed, thus minimizing the chances of metastasis.

The insertion of radium needles into the bladder wall about the line of resection causes the formation of sloughs which have in some cases remained for four months. Such a procedure is valuable in minimizing the chances of local recurrence by destroying stray cancer cells and involves no risk or discomfort.

Malignant papillomata should be removed by resection, the line of resection being fortified by the insertion of radium needles.

While the cases reported are too recent to warrant the drawing of conclusions, the course of these cases so treated has been decidedly more satisfactory than in those treated by methods formerly employed.

REFERENCE

(1) *Gardner:* Trans. Amer. Urol. Assoc., 1915.

EXPERIMENTAL STUDY OF GUM ACACIA AND GLUCOSE INTRAVENOUSLY FOR TRAUMATIC SHOCK

By LILIAN K. P. FARRAR, A.B., M.D., F.A.C.S.

Junior Attending Surgeon

AND JAMES V. RICCI, A.B., M.D.

Adjunct Assistant Surgeon

ALTHOUGH the cause of surgical shock is still a debatable one the symptoms of shock are constant. The clinical picture is always one of depression which is more or less profound according to the degree of shock present. The condition is characterized by collapse, pallor, shallow respiration, rapid feeble pulse, and cold clammy sweat. There is a marked fall in blood pressure, a diminished blood volume due to the escape of plasma into the tissues and a stasis of blood corpuscles in the peripheral capillaries with increased viscosity of the blood and a diminished alkali reserve or CO_2 of the blood causing a condition of acidosis in the tissues. As the result of this diminished blood volume there is a decrease in the tissue oxygenation and in renal elimination so that the tissue toxins increase rapidly in the body, and the tissue cells are soon impaired. Final paralysis of the vital nerve centers then follows. If the blood volume can be restored to normal or nearly normal by an innocuous fluid, provided the loss of blood does not equal more than one-half of the total blood volume, the oxygenation of tissues will be restored and elimination of toxins by the kidney tubules will result. If the total blood loss is equal to or greater than one-half of the whole blood volume the circulation can be maintained for a short period while a donor is being obtained for a blood transfusion. In an article by one of us (Farrar) the beneficial effect of glucose and gum acacia in preventing acidosis in operative surgery has been shown and in a recent study made in the Gynecological Department of Cornell University Medical College at the Woman's Hospital on 53 cases in which gum glucose was given to prevent or combat surgical shock it was found that a solution containing 6 per cent gum acacia in saline and 20 per cent glucose given intravenously:

1. Will increase and maintain from two to six hours at least the blood pressure in 66 per cent of the cases;

2. Will raise and maintain blood pressures which have dropped to a dangerous level;

3. Gives a prophylaxis against shock of over 85 per cent;

4. Gives a prophylaxis against death from shock of 89 per cent. The following studies have been made by one of us (Ricci):

1. THE EFFECT OF GUM GLUCOSE SOLUTION IN VITRO WITH WHOLE CITRATE HUMAN BLOOD

Four c.c. of blood to 1 c.c. of 2.8 per cent citrate solution. This blood was diluted 1 c.c. to 24 c.c. of saline. A loop of this dilution of blood gives an even distribution of cells possible for microscopic inspection. One c.c. of the above concentrations has been used throughout this experiment on the assumption that an individual of 150 lbs. has approximated 3500 c.c. of blood—to whom 250 c.c. of solution is given, it can be estimated that 1 c.c. of blood comes in contact with $\frac{1}{14}$ c.c. of gum glucose; that is, for every c.c. of blood the individual receives $\frac{1}{14}$ c.c. or one drop of gum glucose solution. .

(1)	1 c.c. 5 per cent blood—1 c.c. of gum glucose					present	hemolysis
(2)	1 c.c.	"	.5	" "	"	–	none
(3)	1 c.c.	"	.2	" "	"	–	"
(4)	1 c.c.	"	.1	" "	"	–	"
(5)	1 c.c.	"	.05	" "	"	–	"

The phenomenon of fibrin clot formation does not occur with the addition of saline to blood until large proportions of saline are added. Hemolysis does not occur even with the largest amount of gum glucose solution.

Agglutination.—Up to strengths wherein one c.c. of gum glucose is added to one c.c. of 1-25 blood saline solution no agglutination occurs; this would be equivalent to adding 3000 c.c. of gum glucose solution. Expressed in clinical entities even 40 liters intravenously in man would produce no injury to the red cell *per se*. It is of interest to note that gum glucose in no way hinders, rather it aids in the coagulation as shown both *in vitro* and *in vivo*.

2. A STUDY OF THE ACTION OF GUM GLUCOSE SOLUTION ON BLOOD IN VIVO

A solution of 6 per cent gum acacia has a viscosity slightly higher than normal blood but less than the viscosity of blood in shock and a solution of 20 per cent glucose given at a timed rate is the amount of glucose that the body tissues will absorb per hour and this is the percentage used in the Woman's Hospital. The following experiment was then made to ascertain if any harmful effect would be produced if higher percentages were used. Rabbits were shocked by being laparotomized, bled, and the intestines manipulated until the blood pressure in the carotids had fallen to a shock level and they were then given in large amounts a gum (6 per cent) glucose (20 per cent) solution. The object being to produce the clinical picture of shock and after gum glucose had been injected to study the specific

gravity and viscosity of the blood and the histologic structure of the kidney, heart, spleen, liver and lungs microscopically.

3. SPECIFIC GRAVITY

The specific gravity was found to vary between 1.048 and 1.051; taking 1.045 as a normal coefficient it is seen that there is a definite concentration in the solid constituents of "shocked blood." Granting a margin of error of a few degrees the figures remain constant and higher than normal in the observation made. The introduction of gum glucose solution elevated the specific gravity and the viscosity still higher; the addition of 15 c.c. raised it from 1 to 2 degrees whereas the additional 30 and 35 c.c. increased it a maximum of 4 degrees. This occurs not because the concentrations of blood cells are further increased—which would perhaps be fatal—but because the gum glucose solution added has a specific gravity considerably higher than that of normal or even shocked rabbit's blood. The estimation made on blood taken an hour after the infusion of gum glucose showed a definite decrease. This compares most favorably with readings observed in cases where saline was infused in lieu of gum glucose. There was an initial decrease in the specific gravity with saline solution but this is invariably followed by a subsequent increase which almost reached its pre-infusion level when estimation was made an hour later. Increased specific gravity and viscosity indicate concentration of the cellular constituents and this is what occurs when saline has left the circulation—and it has been shown to do so by previous experimentation.

4. VISCOSITY

With the figure 3.2 estimated at 25° C. (Burton-Opitz, 3.1) taken as a high viscosity norme, shocked peripheral blood shows a moderate increase immediately following gum glucose infusion; this likewise is due to the fact that the viscosity of the added fluid is considerably lighter than that of shocked blood (5.4). One hour subsequent to the infusion there was a definite drop in the viscosity. The figures ranged from a minimal 3.3 to a maximum of 3.7. The addition of 15 c.c. of gum glucose brought about no immediate appreciable change. With the addition of 30 to 35 c.c. there was an increase of from .2 to .4 points which dropped to a figure lower than the pre-infusion level one hour following the infusion. Somewhat striking are the viscosity readings observed in the cases where saline was given. The infusion of 40 c.c. of saline (the amount necessary to raise blood pressure appreciably) brought about a drop in the viscosity from .2 to .5 points; but one hour later the viscosity rose again to the pre-infusion level. This is another proof that the introduction

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BASELINE B.P.o.
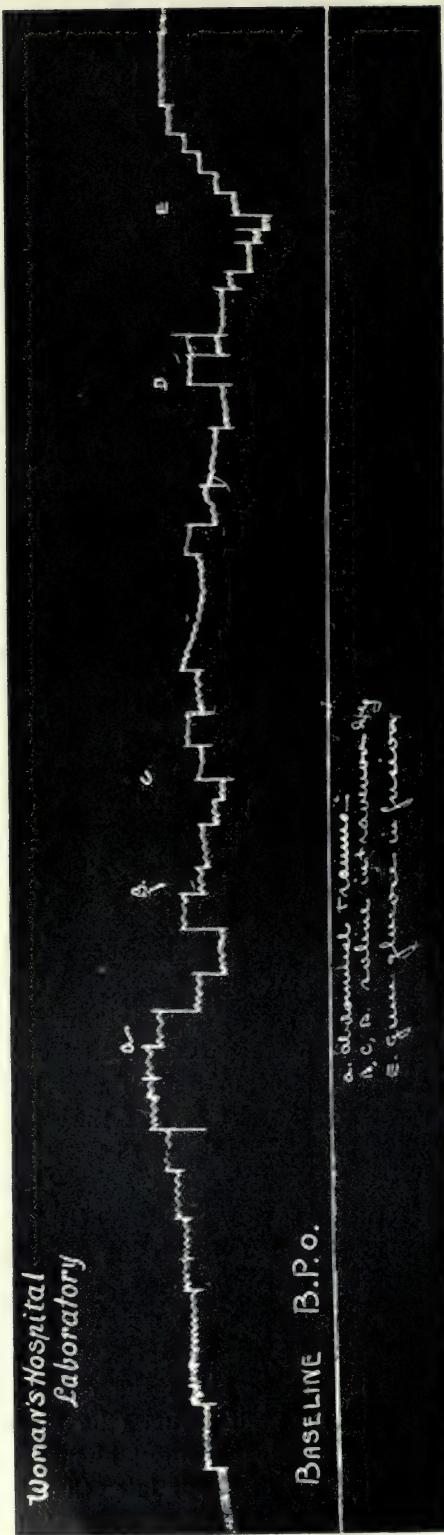
of gum glucose deconcentrates the peripheral blood (the phenome-
non of peripheral concentrations of cells being constant in shock)
while saline does so but temporarily and loses its effectiveness at
least one hour following infusion.

MICROSCOPIC STUDY OF ORGANS

Histologic observations were made on kidney, liver, spleen, heart
and lung and no changes were noticed other than the slight amount
of congestion always noticed in rabbits that have been etherized to
death without previous interference. Finally rabbits were given large
amounts of gum glucose solution intravenously and the capillary cir-
culation of the mesentery viewed under the microscope. The active
movement of the corpuscles was seen without any evidence of clump-
ing of the corpuscles and the rise in blood pressure recorded as fol-
lows: (Fig. 1.)

CONCLUSIONS

1. Six per cent gum and 20 per cent glucose solution given intra-
venously will raise and maintain blood pressure in rabbits that are
in traumatic shock.

2. The same solution does not cause agglutination or hemolysis of
rabbit's blood either *in vitro* or *in vivo*.

3. This solution given intravenously in large amount does not alter
the histologic structure of the tissues of rabbits.

POSTPARTUM RETROVERSIONS: A PRELIMINARY REPORT

By James Kilburn Mossman, M.B. (Tor.)

Adjunct Assistant Surgeon

THE follow-up system of the Obstetrical Service at the Woman's Hospital has been in effect since June, 1920. In view of the large number of patients who were found with retroversion at some time or other while under our observation, it is thought that a preliminary survey of this phase of the work will be of interest. It should be clearly understood, however, that we are dealing only with retroversions, and not with any other condition found postpartum which might cause us to classify the case as other than satisfactory on discharge.

On this service the system has been as follows:

The patient is examined by the attending surgeon when ready for discharge usually on the fourteenth day postpartum. She is then instructed to report back for examination in two weeks—that is one month after delivery. If her condition is satisfactory at this latter visit, she returns again in four weeks, and then comes once more for her final visit at the end of the twelfth week postpartum. She is now classified as satisfactory, unsatisfactory or unchanged, as the case may be. The term unchanged means simply that the patient leaves us with a disability of some sort, but to the best of our knowledge no worse than before this delivery.

When a fundus is found retroverted, it is replaced at once and a pessary inserted, the patient being instructed to come back in a week to see if the pessary is doing its work. If the pessary is not satisfactory, it is changed and the patient returns again in a week for examination. Should the fundus be held well forward by the pessary, the patient reports to us once a month thereafter to have the pessary cleaned and reinserted. She is instructed to douche herself *twice daily* and to take the knee-chest position for 10 minutes night and morning. If there is subinvolution, she is given ergot in addition to hot douches. At the end of three months, the patient is given a week's trial without the ring, and if she returns with the fundus still in good position she is discharged as satisfactory. If not, she is referred to the gynecologic clinic for further attention.

To date we have referred to the follow-up clinic 650 cases. Of these, 315 have been followed through the full three months' course. The remainder proved delinquent in some way or other and will be considered separately.

Completed Cases:

Total number seen.................................... 315
    A.   Found with retroversion at some stage ...... 128 (40 per cent)
    B.   Uterus always found in normal position...... 187 (60 per cent)

The two groups will be analyzed separately on the following pages.

A. *Retroversion Cases:*

    Multigravidae .... 64 (50 per cent)
    Primigravidae .... 64 (50 per cent)
Present Labors:
    Normal .... 94 (74 per cent)
    Abnormal .... 34 (26 per cent)
Abnormal Labors:
    Forceps .... 26 (76.4 per cent)
    Others .... 8 (23.6 per cent)
Puerpera:
    Sapremia .... 12 (9.3 per cent)
Previous Labors of Multigravidae:
    Normal labor .... 36 (54 per cent)
    One or more abnormal .... 16 (24.2 per cent)
    Abortion only .... 21 (33 per cent)
    Abortion and labor .... 9 (13.6 per cent)
Cases showing symptoms since this labor:
    Backache only 10
    Backache with pelvic pain 6
    Backache with bleeding 1
    Bleeding only 5
    Weakness 4
    Constipation 3
    Bearing down sensation 3
    Pain in lower abdomen or pelvis 3
    Pelvic pain with bleeding 1
    Excessive vaginal discharge 1
        Total .... 37 (28 per cent)

It is to be noted that of the few who had symptoms, 45.9 per cent complained of backache, either alone or associated with some other trouble. Next in importance in our clinic seems to have been pelvic pain 27 per cent. Bleeding was present in 18.9 per cent.

Cases with symptoms previous to this pregnancy.................2

1. Primipara, backache for many years previous, was found with retroversion after delivery. No symptoms while wearing pessary and was finally discharged as satisfactory with instructions to return if there were any further symptoms.

2. Multipara, backache since first baby, five years before. Not cured.

Date of Discovery of Retroversions:
    End of 2nd week .... 22 (17 per cent)
    "   " 4th   "   .... 69 (53.9 per cent)
    "   " 6th   "   .... 12 (9 per cent)
    "   " 8th   "   .... 22 (17 per cent)

The remainder were found after the eighth week.

These figures show over 70 per cent of our retroversions to have developed before the end of the eighth week, and if borne out by further investigation point to the urgent need for early and systematic examination of our puerperal women.

B. *Cases With No Retroversion:*

Primigravidae	83	(44 per cent)
Multigravidae	104	(56 per cent) .
Present Labors:		
Normal	133	(72 per cent)
Abnormal	54	(28 per cent)
Abnormal Labors:		
Forceps	36	(66 per cent)
Others	18	
(There were 11 cesarean sections in this group.)		
Puerpera:		
Sapremia	9	(5 per cent)
Previous Labors of Multigravidae:		
Normal labors	64	(63.5 per cent)
One or more abnormal	22	(21 per cent)
Abortion only	18	(17 per cent)
Abortion and labor	34	(32.5 per cent)
Cases showing symptoms since this labor:		
Backache only	18	
Backache with bearing down	2	
Backache with bleeding	1	
Bleeding only	5	
Weakness and pain in lower abdomen	8	
Weakness only	5	
Dragging sensation	3	
Constipation	3	
Sacroiliac pain	2	
Painful micturition	2	
Fainting spells	1	
Acute pain in lower abdomen	1	
Total	51	(27 per cent)

Backache is here, again, the most prominent symptom—41 per cent. There was pelvic pain in 17.6 per cent, and bleeding in 11.7 per cent.

These symptoms have been enumerated in detail in order to show what may be expected from the women who attend these clinics. It is noteworthy that in practically every instance, the symptoms were cleared up very promptly as soon as the patient could be persuaded to take proper care of herself. The majority of these women, on returning home from hospital, plunged at once into household duties (in some cases very onerous) and paid no further attention to themselves until forced to do so by the onset of one or more of the above-noted troubles.

Of these cases that never showed retroversion while with us, seven had complained of certain symptoms prior to this pregnancy.

Primiparae	Pain in lower abdomen	1
	Backache	1
Multiparae	Pain in left lower quadrant	2
	Backache	2
	Backache and bearing down	1

END-RESULTS OF TREATMENT OF POSTPARTUM RETROVERSIONS IN THIS CLINIC

Total number treated 128
  1. Cured .... 79 (62 per cent)
  2. Unsatisfactory .... 40 (31 per cent)
  3. Unchanged .... 9 (7 per cent)

According to these figures, 12.5 per cent of all cases seen through the full postpartum course were discharged with retroversions.

An analysis of the three groups:

	1. Satisfactory	2. Unsatisfactory	3. Unchanged
Primigravidae	40 (50.6 per cent)	24 (60 per cent)	0
Multigravidae	39 (49.4 per cent)	16 (40 per cent)	9

Present labors:

	1. Satisfactory	2. Unsatisfactory	3. Unchanged
Normal	59 (75 per cent)	27 (67.5 per cent)	8 (89 per cent)
Abnormal	20 (25 per cent)	13 (33 per cent)	1 (11 per cent)

Previous labors of multigravidae:

	1. Satisfactory	2. Unsatisfactory	3. Unchanged
Normal	24 (61.5 per cent)	9 (56.2 per cent)	3
Abnormal	6 (15.3 per cent)	4 (25 per cent)	6
Abort. Labor	10 (25.6 per cent)	6 (37.5 per cent)	5
Abortion only	6 (15.3 per cent)	3 (18.7 per cent)	0

Patients *known* to have had retroversion before pregnancy......5. One of these women was discharged cured. The remainder were unchanged.

Delinquent Cases.—

Cases listed under this head are those which did not return at all or which did not make the required number of visits, and are, therefore, not included in the previous groups on account of lack of complete data.

  1. Never returned to follow-up clinic .... 102 (15.6 per cent)
  2. Made one visit only .... 132 (20.3 per cent)
    Primips 66
    Multips 66
  Satisfactory at this visit .... 120 (91 per cent)
  Retroversion at this visit .... 12 (9 per cent)
  3. Made two visits only .... 72 (11 per cent)
  Primips .... 41 (56.9 per cent)
  Multips .... 31 (43 per cent)
  Satisfactory at this visit .... 59 (82 per cent)
  Under pessary treatment at this time .... 13 (18 per cent)
  4. More than two visits but uncompleted .... 29 (4.4 per cent)

All of this group were under treatment for retroversion and stopped attending the clinic when at least one more visit was necessary to determine their final status as cured or unsatisfactory.

20 left after pessary was removed for trial and did not return.

9 left still wearing pessary and were not seen again.

    Total Delinquents 335, or 51.5 per cent of all cases referred.

It is impossible to classify or even give a prognosis in this group. It is evident that a large proportion of our patients have not cooperated as they might have. These women have all been sought out by the Social Service workers and the importance of the examinations explained to them. The reasons given for nonreturn are varied and entertaining, but the main factor is that they feel perfectly well. Certainly it is very difficult to convince women with no symptoms that there may be something wrong. Even those who have been undergoing pessary treatment in this clinic are loath to return for further attention in the gynecological clinic, and relatively few of them are seen again. It is, however, notable that the number of patients cooperating as they should is steadily increasing, and it is believed that this will improve as public education in this subject spreads. Pioneer work in medical education is notoriously slow work, but once started, usually rolls on under its own momentum at an astonishing and ever-increasing rate.

REMARKS

It is, of course, impossible to draw any sure conclusions from such meager figures as are herewith presented, but there are certain features that seem worthy of note and they are given now in order to show the general trend of this investigation.

1. In those cases with retroversion, there were as many primiparae as multiparae. Multiparity does not seem to be a cause.

2. The proportion of normal labors in this group was 74 per cent. Apparently operative delivery does not tend to produce displacement.

3. Among the retroversion cases there were about twice as many who had sapraemia as among the normal cases.

4. There are as many symptoms among those with the fundus in good position as in those with retroversion. The proportion of backaches is about the same in both groups, but in those with displacement there is a well-marked increase in the pelvic pain and bleeding.

5. The occurrence of previous operative deliveries and previous abortions is the same in both groups. On account of the neglect and lack of care often following abortions in this class of patients, it was expected to find a larger number of abortions in the histories of retroversion cases.

6. The time at which most retroversions are discovered has been stated by Studdiford to be during the second month postpartum. Over 70 per cent of our cases were found in the first four weeks following delivery; 17 per cent at the end of the second week.

7. We have not been fortunate in treating women with a history of displacement before this pregnancy. It is hoped at a later date, to present further figures from the gynecologic clinic.

8. We believe the number of unsatisfactory cases discharged (12.5 per cent) is too high, and that this would be very much less had we full information about all our delinquents. As it stands, indeed, there is a great temptation to look upon this latter class (the delinquents) with hopefulness and optimism. One wishes to say, "Here are 132 additional cases, of which 91 per cent got safely past the danger period without any sign of a retroversion. There are 72 more, of which 82 per cent were satisfactory at the end of the eighth week. Is it not probable that those that have come safely so far will continue without further trouble?" Well, we think it is probable. Our small array of figures makes it seem so; but the numbers available are too small for any real decision.

Again, the temptation of the past has been to say, "This patient has no symptoms; she feels perfectly well, and is able to do her work. It is, therefore, unlikely that she has any displacement." The fallacy of this reasoning is apparent at once on examining the lists of complaints and their frequency after delivery. They are very similar whether the patient is found to have retroversion or not.

It is repeated that the above are not definite conclusions, and a great deal more work is necessary if we are to know where we stand as regards causes and incidence of postpartum displacements of the uterus.

CASE REPORT OF AMNIOTIC ADHESIONS FOLLOWING RUPTURE OF MEMBRANES AT SEVENTH MONTH

By Edward Arthur Bullard, M.D., F.A.C.S.

Junior Attending Surgeon

MRS. M. R. T., age twenty-six, came to me in November, 1921, during the third month of her third pregnancy. She had miscarried at the second month, in July, 1921, because of an incarcerated retroversion and feared another such misfortune. Six years ago her first pregnancy terminated normally with the birth of a full term healthy child weighing six and one-half lbs. The patient had enjoyed good health always except for minor diseases of childhood.

Examination disclosed a retroverted uterus about two and one-half months pregnant. I replaced it bimanually, and the pregnancy progressed normally.

At the beginning of her seventh month the patient passed through a period of several days of mental and physical strain due to family troubles. At the end of this time she was wakened in the night (March 8) to find the bed quite wet. She discovered a slight but constant trickle of watery fluid from the vagina, and this continued until morning. I saw her four hours after the flow began. On examination about an ounce of pale watery fluid was found in the vagina having an odor suggesting amniotic fluid. From an inspection of the towels used during the night I estimated that she had lost a quart of this fluid. The cervix was not at all dilated, the fetal heart was normal. The patient was kept abed, the dribbling almost stopped and at no time did she have any suggestion of uterine contractions.

The following day her condition was unchanged and she had lost about six ounces more. This state of affairs continued day after day; fetal movements active and fetal heart normal, cervix very slightly dilated, and an estimated loss of from one to four ounces of amniotic fluid daily. I collected a sample of this fluid from the vagina and Dr. Archibald McNeil reported it "amniotic fluid—not urine." Invariably there was more dribbling when patient was recumbent than when she sat up, and so, beginning March 22, two weeks after the initial rupture of the amniotic sac, patient was allowed to sit in a chair. After eight days of this there seemed to be no reason why the patient should not walk about a bit. The daily amniotic leakage had persisted unchanged in amount, the fetal heart had continued normal and the uterus seemed to be enlarging. There had been no pelvic discomfort, the patient's temperature had been normal all this time but the pulse averaged ninety.

On March 30 the patient was permitted to take a few steps, and as no untoward results were noted and her impatience and boredom were great, she remained up and about her room every day. During the afternoon of April 3 there was a sudden gush of a pint or more of amniotic fluid, and sluggish uterine contractions began. These pains continued of poor quality and very irregular until nine P. M. after which they improved, averaging a half minute duration and five minute intervals. At midnight examination showed one finger dilatation and cervix not taken up at all. Pains continued unchanged in character and frequency all night. By morning the patient was tired and discouraged, cervix taken up but only two fingers dilated, pulse slightly irregular, 110 to 130, and a systolic murmur formerly heard only at the base of the heart and considered functional was now very loud

and heard all over the heart. Dr. George N. Slattery was called in for an opinion on the cardiac condition and advised prompt delivery with as little tax on the patient's strength as possible. Accordingly, under drop ether anesthesia the cervical dilatation was completed manually. Uterine contractions having ceased, the head was crowded down into the birth canal, forceps applied and the head delivered. The shoulders appeared, but, strangely, did not advance. Passing my hand into the vagina and along the child's back I felt a wide, taut, membranous band which seemed attached to the upper arm or lateral wall of the chest and extended inward toward the uterus. As the anesthetist had reported that the patient was in poor condition my chief thought was rapid delivery and I promptly broke this band by a sharp jerk and the child immediately slipped out. The baby's heart was acting well but his respirations were very feeble and irregular. The cord was ligated and care of the infant delegated to Dr. L. V. Lyons, the anesthetist. The placenta

Fig 1.

was expressed by Crede's method after a half hour and examination of it and the membranes revealed nothing abnormal. The mother made a good anesthetic recovery; her cardiac action became stronger at once and gave no further trouble.

Despite long immersion in warm water and other therapeutic measures the child showed no improvement over its feeble condition at birth. The circulation was poor, respirations very shallow and irregular and after seven hours it succumbed. Autopsy was refused. The baby weighed three lbs. and showed normal development in every respect. About two inches above the right elbow there was a deep groove partially encircling the arm. The constriction was deepest on the external surface where it appeared to have nearly reached the bone, whereas on the inner aspect of the arm where it normally lies in contact with the chest wall there was no constriction at all. This explained the fact that the arm and hand below this constriction were entirely normal in every respect, for there had been no pressure on the great vessels and nerves. There was not the slightest edema or any difference of color of the skin of the forearm and hand. Careful examina-

tion of the groove showed the usual appearance noted under sharp continuous pressure. The soft tissues in the groove and for a half centimeter on either side were bluish red in color but the skin was not broken.

The most reasonable explanation of the groove in this baby's arm appears to the writer to be that at some time after the initial rupture of the membranes the uterus was so nearly empty of fluid that the amnion lay about the fetus in folds. A fold then became adherent to the outer side of the arm; and later as the amniotic fluid was replenished, perhaps aided also by the child twisting about, traction was brought to bear on the adhesion and this resulted eventually in a pressure groove.

Much well-founded skepticism exists concerning intrauterine amputations and deformities alleged to have been caused by amniotic adhesion bands. As Bailey pointed out recently many of these are cases of arrested development. However, there are a considerable number of authentic cases of extensive adhesions of amniotic bands.

This infant was shown at a Weekly Staff Conference at the Woman's Hospital and none of the obstetricians and gynecologists who examined it expressed doubt concerning the nature of the condition or its cause.

Adhesions have been found densely attached to various parts of the child. Berdeleben and Whitridge Williams have reported cases in which adhesions from placenta to child were sufficiently firm to interfere with delivery. In Braun's cases strangulation of the umbilical cord and fetal death were reported.

Adhesions of amnion to fetus usually occur very early in pregnancy and I feel sure that adhesions produced, as in my case, by folds of a collapsed amniotic sac at the sixth month is a unique condition of very rare occurrence.

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REPORT OF A CASE OF HEMATURIA FOLLOWING INFLUENZA

By Francis E. DuBois, M.D.

Assistant Urologist

WHEN a case of hematuria presents itself to the urologist, his first concern must be to determine from what particular portion of the urinary tract the blood is coming; next, the exact nature, if possible, of the pathology to be dealt with, and lastly to institute treatment, whether medical or surgical, for relief of the condition. When the pathology is of such a character that medical rather than surgical measures are to be resorted to, his duty does not end until he has further laid down a course of action for his patient, whereby future attacks are to be guarded against, by instructions as to hygiene, diet and other therapeutic measures.

Furthermore, it would be advisable if we could so educate our patients to the necessity for reporting at regular intervals, perhaps every six months, not only for observation but also with a view to encouraging them and seeing to it that instructions are being properly carried out. Not only is this true of so-called medical conditions which present the symptom of hematuria, but it is equally applicable in those cases where an operation has been necessary, and the writer is firmly of the opinion that a surgical patient discharged "cured" needs to be observed occasionally, as well as the one leaving the medical side of the hospital.

Granting that a case of hematuria can be studied during the active symptoms of the attack, there should be no difficulty in the vast majority of cases of making a positive diagnosis. In recent years by means of the cystoscope, combined with the use of the x-rays and urograms, the old term of "Essential Hematuria" is rapidly going into the discard. It is only where a patient is seen after the bleeding has stopped, that the diagnosis becomes a matter of greater difficulty, and for this reason a patient with hematuria should at once be referred to the urologist for examination.

In a great number of these patients, the bleeding stops of itself and then the location of the lesion is often a difficult matter, and in some cases not possible. Burgess[1] in an analysis of 100 cases of symptomless hematuria found that in 35 cases, apparently renal in origin, 14 were undiagnosed owing to not having been seen during active bleeding, and he suggests that contrary to the established custom of putting the patient at rest and allowing the symptom to subside, he

should be encouraged to move about with a view to continued hema-
turia until such time in the immediate future, as the services of a
competent urologist could be obtained.

As soon as the laity is made to realize by physicians that hema-
turia which is noted by the patient, whether painless or not, whether
of short or long duration, is always one of Nature's warnings and
should be at once investigated, just so soon will we be more surely
able to properly diagnose and treat these conditions and in many
instances cure what, if left to itself, may later on develop into an
"incurable" case.

Kretschmer[2] in analyzing 238 cases of hematuria found that the
vast majority of the cases were due to either tumor, calculus or tu-
berculosis, and that 50 per cent of the cases analyzed were caused by
some neoplasm in the urinary tract.

Chute[3] in 1920 reviewed a series of 100 of his own cases of hema-
turia, excluding cases of traumatism, acute inflammation of the blad-
der and a few cases where he was unable to definitely assign a cause,
and found in the above series, 58 were due to new growths in some
portion of the urinary tract.

It is not the purpose of the writer, nor within the scope of this
article to enter into a discussion and enumeration of the many causes
of hematuria, but rather by reporting a case, to illustrate one of the
causes of this condition which is not infrequently seen in the Depart-
ment of Urology of this hospital.

Pyelonephritis is not an uncommon condition and is at times ac-
companied by hematuria. Bugbee[4] in a most interesting paper on
"Infections of the Genito-Urinary Tract Complicating Influenza"
made a most careful analysis of 39 personal cases, and found infec-
tions in one or both kidneys in 22 of these, 8 of whom had suffered
previously with urinary disturbances. There was profuse hematuria
in 2 cases, and in 13 cases one or both kidneys could be palpated at
the time of the examination. He therefore naturally came to the
conclusion that "these cases demonstrate that kidneys, once the seat
of a lesion or subject to interference with drainage, are more vulner-
able when the individual is attacked by a severe infection."

The following case was referred to the Urological Department by
Dr. R. M. Rawls for diagnosis and treatment and presents several
points of clinical interest.

May 25, 1922. I. H., a married woman thirty-two years of age, stated that for
the past three weeks she has noticed continuously blood in the urine and that
during this same time there has been a moderate dull, aching sensation in the
left upper abdominal quadrant and in the lumbar region of the same side. There
have been no other symptoms, neither dysuria nor frequency of urination.

In October of 1918 she suffered with a severe attack of influenza, lasting
five weeks and was said to have had a bilateral pneumonia at that time. During

DeBois: Report of a
Case of Hematuria following
Influenza

Woman's Hospital
Report, Vol. IV.

Fig. 1.

DuBois: Report of a
Case of Hematuria following
Influenza

Woman's Hospital
Report, Vol. IV.

Fig. 2.

this attack she had a painless hematuria ''practically all of the time'' and for two months afterwards. The hematuria then ceasing of itself, without any treatment. During the first year of her married life thirteen years ago, she had one miscarriage at the sixth month which was apparently due to a severe attack of pertussis. A small cyst was removed from her right breast twelve years ago, which on section was negative for malignancy. She has always been constipated. Aside from this, the personal history was negative.

It is interesting to note, however, that in 1918 one brother died of influenza and a sister in 1919 of the same disease.

Examination showed a fairly well nourished woman, in whom the physical findings were negative, except for a very slight tenderness in the left costovertebral angle and just below the costal margin of the left side of the abdomen on bimanual palpation.

Cystoscopic Examination.—About four ounces of urine, thoroughly mixed with blood, were evacuated through the cystoscope. The return flow from the bladder quickly became clear on irrigation. Except for slight pressure on the fundus and moderate congestion of the trigone, the bladder mucosa was normal. The right ureteral orifice was normal in position and appearance. From the left ureteral orifice, which was also normal in position and appearance, there was an intermittent jet of bloody urine.

No. 5 F. radiographic catheters passed easily 32 c.m. to each kidney pelvis. The flow from the right side was normal with slightly cloudy pale yellow urine. On the left, flow was normal but the urine was extremely bloody.

The analyses of the differentiated urines was as follows.

Right	Left
Very pale yellow. Slightly cloudy. Acid—marked trace of albumin. Urea 1.841 per cent.	Bloody in appearance. Acid—marked trace of albumin. No sugar. Urea 1.689 per cent.
Sediment: Many pus cells. A few epithelial cells. No growth on culture.	Sediment: Very many red blood cells. Many pus cells. Very few epithelial cells. No growth on culture.

A radiograph taken at this time, with catheters *in situ*, showed the left kidney slightly below its normal site. There were no abnormal shadows.

The patient was given methylene blue in one grain doses, three times a day, advised to remain quiet and to take at least six or seven glasses of water daily. When next seen on June 6, 1922, she reported that the hematuria and pain had ceased the morning following the cystoscopic examination and had not recurred.

A urogram of the left kidney pelvis was made at this time with 14 c.c. of a 20 per cent solution of sodium bromide and showed a rather typical condition such as is frequently found in pyelonephritis, with moderate dilatation of the pelvis and ''clubbing'' of minor calices. Fig. 1 shows this radiograph and should be compared with Fig. 2, which is a beautiful example of a normal kidney pelvis, the injection in this latter case having recently been made by Dr. Henry G. Bugbee and in the writer's opinion is one of the most perfect urograms of a normal kidney pelvis he has seen.

The patient showed continued improvement under regulation of diet, intended to relieve the constipation and to put as little strain as possible on the kidneys. There has been no recurrence of the bleeding, and when last seen on the 31st of October, she reported feeling very well and having gained 15 lbs. in weight. The catheterized bladder specimen taken on this date showed an absolutely normal urine in every respect on analysis with no growth on culture.

This case has been reported by the writer, not because of an unusual or rare condition, nor because of a wealth of physical and laboratory findings and tests, but rather because of the fact that it is a distinct type of recognized lesion causing frequently rather severe hematuria, occurring independently of, or in connection with, some acute infectious disease, or directly dependent upon some focal infection. In this instance, in the absence of any definite focal infection and with an antecedent negative urinary history, it seems only fair to presume that the pyelonephritis originated as a complication of influenza.

Furthermore it is just such cases which are capable of being improved by proper medical supervision and the dangers of future recurrences and greater damage to the kidneys minimized.

It is of interest to note that the hematuria ceased within twenty-four hours of ureteral catheterization. It is impossible to say whether this was due to the draining of the kidney pelvis at that time or whether to the methylene blue; at any rate it has been our experience in this clinic that methylene blue in small doses is a valuable aid in checking bleeding from any portion of the urinary tract.

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OBSTETRICAL ANALGESIA*

By RAYMOND C. COBURN, M.D.
Anesthetist

THE use of nitrous oxide for obstetrical analgesia is based upon sound physiology:

It does not increase the already heavy burden thrown upon the organs of elimination, nor have an accumulative effect as do ether and chloroform when repeatedly administered over a considerable period of time.

It does not delay the progress of labor, as do the other analgesics and anesthetics including the alkaloids, by inhibiting the contractile fibers of the uterus. But, in striking contrast, it stimulates contraction of the uterus, and thereby directly shortens the period of labor.

It does not depress the patient, but conserves her resistance, thus rendering the puerperium more free from all the complications that follow in the wake of impaired vitality. The benefit of conserving the mother's vital forces is not reflected alone in the more normal delivery but in the superior physiologic state, as well, in which she is left afterwards.

It is the least toxic general analgesic known, and its effect is so quickly secured and its elimination so promptly effected that the patient is subjected to its influence only during the time that it is needed. This is another important contrast to all other medicinal means for the relief of obstetrical pain.

It does not injuriously affect the baby. So few inhalations need be given at a time, and then only when the uterus is contracting or contracted, and elimination is so rapid, that very little, if any, nitrous oxide reaches fetal circulation.

The exact mode of action by which nitrous oxide produces analgesia, which may be defined as loss of pain-sensation but with consciousness retained, and anesthesia, where there is a loss of both consciousness and pain-sensation, is not definitely known, but it is generally considered to be interference with oxidation in the brain and nerve cells. Certain it is that in prolonged administration the difference between producing analgesia and anesthesia is a matter of the amount of oxygen concomitantly administered. In other words nitrous oxide analgesia may be prevented from developing into anesthesia either by withdrawing the agent or by simultaneously administering sufficient oxygen. In obstetrical work the former is the usual method.

The proper time to begin the administration is important. If too soon, it will not be effective, and cooperation on the part of the patient will be more difficult to secure. And this raises a very important point in the procedure—the psychology of the patient. If the best results are to be attained the patient's confidence must be secured, and herein, I believe, lies one of the great differences in results obtained. Few physicians realize the importance of the mental attitude of the patient before the administration of an anesthetic. The parturient woman is particularly susceptible to influence and suggestion, but she must be properly handled to secure her full cooperation, and without this cooperation analgesia cannot be made a success. The psychologic phase of obstetrical analgesia has not received its proportionate consideration. Firmness, but withal gentleness, sympathy and optimism, help to influence the patient's psychology in the right direction.

From the casual point of view the analgesia is to prevent suffering, so it should be instituted whenever the contractions produce a decided pain. This will occur at varying stages in different patients, and with the same individual in different labors. In general, begin the administration in primiparae when there is a three or four finger dilatation of the cervix; in multiparae, a little later, and sometimes not until the beginning of the second stage.

When the early contractions are ineffective and "nagging," a medium dose of morphine should be given hypodermatically. This usually quiets .the contractions for a time and helps to soften the cervix, so that later, when they begin again, they will be stronger and the cervix more pliable. In such cases the administration of nitrous oxide should be deferred until the more vigorous and effective contractions are secured.

Not every type of nitrous oxide apparatus is adapted for obstetrical analgesia. The requirements for this work, where the administration is intermittent, differ in some respects from those of general surgery where the administration is continuous. It is important that all valves be in good working order, the mask fit the face properly, and the apparatus be adapted to furnishing nitrous oxide pure, or with oxygen, without the slightest delay, and sensitive to effecting quick changes in the percentages of the mixture inspired by the patient. Herein lies a common source of error. The patient takes so few inhalations that often the percentages shown on the apparatus nowise indicate that which the patient actually inhales. A simple apparatus is to be preferred for this work.

At the beginning of a contraction, announced either by the patient or detected by a hand on the abdomen, the mask should be quickly applied. and the patient take three or four deep inhalations, then

hold her breath as long as possible and "bear down." Holding the breath prevents the rapid loss of nitrous oxide through exhalation, and "bearing down" increases its rate of absorption and augments the expulsive effort.

While I wish to emphasize the necessity of beginning the administration in most cases at the first indication of a contraction so that analgesia will be established before pain is experienced, yet when the contractions have a slow onset the administration must not be begun so soon, else the analgesia will subside before the painful part of the contraction reaches its peak.

The number of inhalations to be taken with each contraction is important, and it should always be the minimum to produce the desired results. It needs to be varied not only with different patients, but in the different stages of progress with the same patient. At first, three or four inhalations are usually sufficient. Later, when the contractions become more powerful, six or eight, or even ten, inhalations are required. The tendency is to give, and the patient to want, too many inhalations.

Only sufficient nitrous oxide should be given to produce analgesia, for the patient very quickly passes into anesthesia, and this is to be avoided (except toward the end of the second stage and in precipitate labors) as it destroys voluntary cooperation. When the patient is relieved from pain but kept conscious her voluntary cooperation in the expulsive effort is greatly increased, so that indirectly, as well as directly, this type of analgesia materially shortens labor. From the strict scientific point of view this is probably its most important effect, but its practical significance has not been generally recognized. The analgesia *per se* has been emphasized with but little attention directed to the impetus it gives to the natural forces of labor, shortening the period in all, and changing the character in many to a more spontaneous delivery.

There is a marked difference in the oxygen requirements of different patients, and, of course, the number of inhalations given at a time affect it also. For the first three or four inhalations oxygen unnecessarily delays the analgesia, and most patients will take twice this number of inhalations without showing oxygen deprivation. However, cyanosis must be avoided and either a small percentage of oxygen, or a larger amount of air, must be given when indicated by the color of the patient's cutaneous circulation.

When the contractions are too strong, considering the resistance imposed, nitrous oxide analgesia should not be used, for here the indication is inhibition to the contractile force. Hence ether or chloroform are the agents of choice in precipitate labors.

When the head is passing over the perineum it is usually advisable

to have the patient anesthetized, and often with a more potent anesthetic than nitrous oxide, though with susceptible patients, or when the contractions are weak, it may be sufficient. When the contractions are normal, ether or chloroform may be given to advantage on an open mask at this time. The former is preferable except when the contractions are vigorous or a quick effect imperative. The preceding analgesia lessens the amount of anesthetic required, so chloroform must be used with especial caution under these circumstances.

When an anesthetist is not available, an apparatus with self-filling bags and automatic shut-off on the inhaler makes self-administration a good substitute. The patient soon learns to apply the mask at the beginning of a contraction and take a few inhalations. If there is a good spring on the shut-off valve it will stop the gas before anesthesia is established.

If an automatic apparatus is not at hand, any one who may properly be in the chamber may sit at the bedside and keep the bag filled, but the patient should handle the inhaler rather than the untrained attendant.

There have been questions raised concerning the establishing of respiration in the baby born after nitrous oxide analgesia. My observation has been that where the intermittent type of analgesia has been used there has been no special difficulty. And when in addition to the analgesia, ether or chloroform is used as the terminal anesthetic, there is less difficulty than when these agents are so used without the preceding analgesia. This, I believe, is due to the fact that the analgesia lessens the amount of the terminal anesthetic required.

Whenever the baby is cyanotic, and the cord is still pulsating, several inhalations of pure oxygen by the mother before the cord is tied will quickly clear the circulation.

Properly used nitrous oxide analgesia is much more than a humanitarian utopia. It conserves the mother's vitality, shortens labor, and assists Nature at the essential points. It ought, therefore, to be regarded rather as a conservator of life.

BLOOD TRANSFUSION*

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THE early history of blood transfusion is a long one, and there are many excellent reviews of it.[8, 59] More progress has been made since the start of the World War than during its whole history. It is now a safe procedure in competent hands which can do no harm and yet be of immense value, especially if given early, before the need becomes too urgent.

INDICATIONS

If blood transfusion is looked upon as a homologous transplant of living tissue,[31] which has been shown to live for at least 30 days in the recipient,[4, 5, 6] the indications are infinite:

1. *In acute hemorrhage,* as substitute for lost blood, it offers immediate relief, when the addition of red blood cells is urgent for further maintenance of vital processes, since permanent degenerative changes have been shown to occur in the body when the exsanguinated condition persists for more than a few hours.[65] In spite of air-hunger, the amount of hemoglobin retained in the severest hemorrhage is above the point necessary to sustain life so that there is a factor besides the mere oxygen carrying power of the R .B. C.[69] While useful in gastric or duodenal ulcer, postpartum hemorrhage, placenta previa, ruptured ectopic gestation, ruptured uterus, typhoid hemorrhage, etc , transfusion becomes imperative when the R. B. C. are one million or less, and the hgb. 20 per cent in acute hemorrhage.[21, 47] When there is reduction of R. B. C. below 4,500,000 in 3 hours, 4,000,000 in 8 hours, 3,500,000 in the first 12 hours in wounded men, the patient dies.[19] If after transfusion a patient improves and then becomes worse it is a sign of renewed bleeding, as a rule; if the bleeding is not certainly stopped, transfusion can help where saline or *any* other fluid fails.[28] The effect of saline intravenously is very transient, gum glucose solution intravenously is preferable.[28] Blood pressure is another valuable indicator and should not be allowed to go below 70 mm. of mercury.[5, 28] At this level enters the factor of shock, usually combined with hemorrhage. If it is known that the patient has not bled unduly, a solution of gum glucose intravenously is quite as effective as blood, though no better, but easier to give,[25] where a boost of blood pressure alone is the most pressing need.[8, 28] Seventy mm. of mercury blood

pressure would be no guide in a patient of a blood pressure of 200 mm. originally, so that the original pressure or age must be considered. Knowledge of the amount of blood lost is a valuable guide, not available if it is a question of concealed hemorrhage; and although obstetrical cases seem to stand blood loss better than others (the average woman at delivery can stand 1250 to 1500 c.c. loss with little or no ill effect), several fatalities are reported in which the loss barely exceeded 1500 c.c.[89] Mere reinjection of serum, however, is not sufficient,[18] so that in cases of bad hemorrhage while there are temporary measures available, nothing will supplant transfusion of whole blood.

2. *Prophylactic transfusion*, preliminary to, during or just after operation in cases of postoperative hemorrhage or shock,[16] is also indicated in uterine bleeding from malignancy, for fibroids and most conditions described above (1), when prolonged or large hemorrhage is threatened.

3. *To increase coagulability*, as a styptic, where the serum and plasma are most needed, but alone will not suffice. They will work best in the form of whole blood in purpura, hemophilia, and hemorrhages due to the blood diseases; also in hemorrhage of the newborn for which it is a specific[47, 70] when the coagulation time of the newborn is increased;[70] in oozing from the uterus of a patient who has already lost much blood and in whom the uterus will not contract for that reason;[9] also in the slow oozing provoked by jaundice, more especially postoperative. Paradoxical as it may seem, citrated blood, although containing an anticoagulant, temporarily gives a slightly lower coagulation time in these cases than the whole blood, having equal hemostatic quality.[42, 88] If serum alone is used as substitute for transfusion, which it cannot rival, "serum-serique"[69] (two doses of 10 c.c. each) is said to be very effective (serum from rabbits in a state of anaphylaxis to horse serum). Peptone is also advocated,[85] as also whole blood subcutaneously.

4. *For stimulation of hematopoietic organs.* Transfusion represents more than the mere addition of a given bulk of blood in pernicious anemia, leucemia, secondary anemia due to chronic infection or malignancy.

5. *For toxic conditions,* such as postpartum sepsis or any acute or chronic infection; for bacterial endocarditis, where immunized blood should be more valuable than unchanged blood. "Immuno transfusion"[90] surpasses ordinary methods of serum therapy in septicemic cases inasmuch as we are dealing with compatible human blood immunized *in vitro*, showing definite protective substances which can be incorporated in indefinitely large quantities of blood transfused. They serve the double purpose of new blood and of antibodies. Repeated small transfusions of 250 to 300 c.c. blood are the only remedy at hand

in conjunction with general therapeutic measures. Since 23 per cent of bacteriemias, due to streptococcus in postpartum patients, end fatally, and in thrombophlebitis, 50 per cent of the women (with bacteriemia) do not recover, early and repeated small transfusions should be tried, though they are less effectual if there be a local point of sepsis.[14, 45, 68] Puerperal anemia is another field where transfusion is a therapeutic adjunct to arsenic, etc.[79a] In eclampsia, whole human blood from male or female donor seems experimentally to neutralize the toxic effect of the patient's blood to a greater extent than mere dilution with so much fluid.[54] Benzol poisoning and illuminating gas poisoning are benefited by withdrawal of blood which is replaced with quantities of fresh blood. It is even suggested that leprosy is improved by transfusion, but this seems doubtful.[45]

RESULTS

If good technic has been employed the results are always excellent—otherwise vary in proportion to the attention given to details. Occasionally, there will be an unavoidable reaction but with due care this will not be great. The individual necessarily profits by the operation because a definite volume of blood has been transferred to him, the R. B. C. of which will survive from one to two months,[4, 5, 6] as ascertained by later count.[6] The serum will transfer antibodies and the whole blood will stimulate the hematopoietic organs to renewed activity.

METHODS

Methods are numerous. There are many historic reviews.[8, 59] The direct vessel to vessel anastomoses are no longer done, other methods are so much simpler, equally effective, and do not mutilate the donor. Of the indirect methods the paraffined glass receptacle[36] has its limitations and advantages; the method of coating with paraffine has been simplified.[3] The two methods most used today are (1) the syringe-cannula method[44, 91] with its modifications in the form of three-way stopcocks,[26, 40, 83] the ball and valve modifications being too elaborate and too easily put out of order, and (2) the anticoagulant method of using citrate.[1, 34, 42, 88] Citrate has taken the place of hirudin and other anticoagulants. Strange as it may seem, it was found that the anticoagulant did not destroy the hemostatic quality of the blood in cases of oozing, jaundice, melena and purpura.[88] The amount of citrate used has been diminished to 0.2 per cent as a minimum,[42] the majority of men preferring 0.24 to 0.30 per cent when diluted with the blood.[35, 59, 62] From the simple intravenous set for injecting citrated blood, more elaborate methods evolved,[5, 24, 30, 65] but one can always rely on this method. There need be no fear of toxicity of

sodium citrate if used in 0.24 to 0.30 per cent strength for 300 to 1000 c.c.[13]   On the other hand, the citrate method is generally conceded to be a little more apt to give a very mild reaction.[8, 22]   There is no question but that the citrate method is more convenient, although by the syringe-cannula transfusion larger volumes of blood can be given with less injury to the blood used.

TECHNIC OF CITRATE METHOD

A detailed description need not be presented here.[8, 22, 59]   A neat way of entering the vein consists of first transfixing it with a straight intestinal needle.[86]   Blood is received in a graduated glass which contains citrate enough to give a final dilution of 0.2 to 0.3 per cent (50 c.c. of 2.5 to 3 per cent sodium citrate dissolved in .85 per cent saline solution for 500 c.c. of blood).   It is constantly stirred with a glass rod, care being taken to prevent contact with the sides of the jar or the arm.   A large and free stream from the donor is essential.   Reinjection of the blood into the patient can be accomplished in innumerable ways.   The simplest is filtration through gauze into a bottle which has enough saline to fill the rubber tubing attached, thereby, air bubbles are excluded while the needle is inserted into the vein.   The blood may be kept warm by passing the tubing through a basin of water of the desired temperature, not hot enough to injure the blood. Slow infusion of the blood which in the beginning is somewhat diluted with the saline in the tube, allows one to stop before any of those rare strong reactions, not demonstrable *in vitro*, become pronounced enough to be dangerous.   The rate of injection should depend largely on the patient's cardiac condition.

Donors should be subjected to a general examination, a Wassermann test, and must be free from diseases communicable by the blood stream: such as malaria, typhoid (walking), etc.   They must be carefully grouped, preferably also matched against the future recipient; promiscuous transfusion without any tests is not to be countenanced. Available candidates should be on hand from Group 4.   In case of emergency, great advantage is gained by knowing the reaction of some of the hospital help or other easily accessible individuals.   This procedure is endorsed by many,[41] but to a degree contradicted in the report of the Interallied Surgical Conference where it is stated that, "fatal accidents have occurred from agglutination of the blood corpuscles by the donor's plasma, but that the danger of this is relatively small and, therefore, it may be disregarded at an advanced post."[64]

Isoagglutinins and Isohemolysins.   The prefix "iso-" is used to designate that variety of agglutinin and hemolysin which is effective against the erythrocytes of another animal of the same species as that possessing the agglutinin and hemolysin.[52]   Here lies the keynote to

successful transfusion. All other details may be perfect, yet if the blood of the donor is incompatible with that of the recipient, grave danger may follow—agglutination may occur alone, but hemolysis is practically always accompanied by agglutination,[52] with very few exceptions.[57] Exceptions occur perhaps most often in chronic diseases, where repeated transfusions have been given.[15, 47] Easiest test to determine compatibility, if serum of Groups 2 and 3 is on hand: A single drop of blood from the finger tip is placed into a test tube containing 8 to 10 c.c. of physiologic saline or citrate solution. The tube is shaken to give uniform suspension. On each of 2 cover slips a very small drop of corpuscle suspension is placed; to one a drop of serum of Group 2, to the other a drop of serum of Group 3 is added. Serum and corpuscles are mixed on each cover slip, which is inverted over a hollow ground slide and examined under the microscope. Agglutination may take place in a few minutes, but it is safe to allow a half hour at 37° C. to elapse before a decision is made. Serums of various groups differ in rapidity with which they bring about agglutination: Group 3 takes the longest, Group 2 often 15 minutes to a half hour, Group 4, five minutes or less.[48] Serum in capillary tubes, sealed and preserved lasts six months or more.[49] Many modifications of this test have been made, [11, 74, 75, 76] and it has recently been shown that dried sera do not keep as long as the liquid form.[37] If fresh serum, which has hemolytic as well as agglutinating activities *in vitro*, is used, a mistake may occur by the clumping, being massed or broken up, and the hemolysis then is recognizable only in a diminution of the number of cells remaining in the preparation; therefore, examination must be made immediately after setting up.[15] In newborn infants also it has been found necessary to match the baby's blood against the mother's,[29] contrary to the usual custom.[14] The important thing to bear in mind is that it is the cells of the donor against the serum of the recipient that one ordinarily tries out, the donor's serum being so diluted that it is usually harmless. A medico-legal application has been worked out that makes use of the transmission of these reactions,[58] which, however, are not established permanently until the first or second years of life.[29] With slight changes the figures of the original grouping of Moss still hold good.[17] The amount of reaction *in vitro* is no criterion of how severe the incompatibility will be *in vivo*, therefore, it is necessary to have a perfect match, when grouping is done.

DANGERS OF TRANSFUSION

Four types of accidents may occur: (1) acute cardiac dilatation; (2) embolism of air (less dangerous than supposed) and of clotted blood, these two accidents and the one following should not occur with due care; (3) introduction of infection into the blood serum

(syphilis, typhoid, malaria); (4) agglutination or hemolysis reactions of which there are three types: (a) following the use of compatible bloods—a slight chill and rise of temperature, (b) so-called hemolytic reaction following the use of incompatible blood, (c) severe reaction, rarely occurring in patients who had previously received many transfusions of blood from a donor of the same group, therefore, compatible in the ordinary sense. The first two accidents are prevented by adequate care and cleanliness and lack of trauma to the blood,[22] and proper tests; the last is unavoidable and manifests itself after the introduction of from 50 to 100 c.c. of blood, therefore, transfusions must be started slowly so that they can be stopped in time to avert a catastrophe. Its symptoms are tingling pain, fullness in the head, distress about the chest, later, excruciating pain in the lumbar region; then follows cyanosis, labored breathing, slow pulse, loss of consciousness, urticarial eruption; finally, rapid pulse, cold and clammy skin, chill, high fever (103° to 105°), in all, the symptoms of anaphylactic shock. Jaundice and macroscopic hemoglobinuria develop later.[15, 22, 60] If the transfusion is stopped early and fluids (glucose) are given intravenously with adrenalin and atropine, the condition usually clears up. These reactions in cases where the blood has been properly grouped, are thought to be caused by the liberation of toxic substances, probably from platelets in the incipient stages of blood coagulation. This can be avoided by fairly large needles and short tubing, and, in case of obstruction or stoppage, by the use of a new needle and tubing.[49, 67, 77] Therefore, the cleaner the apparatus is, and the less the blood is injured, and the more quickly it is injected, the slighter will be the reaction. Citrate may slightly injure the cells.[22] A further explanation of this reaction, simulating an anaphylactic shock, and by it a possible means of avoiding it, may be found in the fact that the liquor obtained by grinding a toxic serum has become nontoxic to cells (R. B. C. or leucocytes) to which it formerly was toxic.[10]

AUTOINFUSION

The most noteworthy progress in transfusion of blood, brought out in German literature during the war, is the procedure of reinjecting extravasated blood after modifying it, intravenously, intramuscularly, or intrarectally, a method originated by Thies[82] in 1914. The first impression of this autoinfusion of blood is one of impracticability, but it is indorsed, especially for cases of tubal pregnancy, so unreservedly by such authorities as Bumm, Doederlein, etc., that it may be well to give it more careful consideration. In German work on transfusion not enough emphasis is placed on the value of grouping patients. This may account for some of the accidents simulating those resulting from hemolysis or anaphylactic shock. The proportion of citrate used in all

their transfusion work is much greater than that used in this country.[30] Doederlein adds five cases of autotransfusion to a total of fifty-one in April, 1920. An outline of his technic is as follows: A soup ladle or large spoon or grooved retractor is used to remove the blood from the peritoneal cavity; this means less trauma to the blood than suction. The blood is allowed to flow, by gravity, into a funnel covered with several layers of gauze. It is filtered into an Erlenmeyer flask where it is mixed with 1 per cent sodium citrate solution in the proportion of 3 parts of blood to 2 of citrate and kept at body temperature. By means of an intravenous set it is poured into the inferior mesenteric vein, or a vein of the leg.[38] arm, or injected intramuscularly or subcutaneously, but preferably into the internal vena spermatica (ovarian) into which an assistant meanwhile has inserted a cannula with a lumen of 3 to 5 mm. (the last vessel rather awkward to get into?). If possible this is not done until after active bleeding has been stopped.[29, 72] All of the cases with unfavorable symptoms recovered. The amount introduced varies from 500 to 1000 c.c. Doederlein does not agree with Opitz and Olshausen,[55] that free blood left in the peritoneal cavity is rapidly reabsorbed. Therefore, after removal of the blood to be used for reinfusion in ruptured ectopics he washes out the peritoneum with 20 to 30 liters of saline solution at body temperature. (It has been shown that 100 c.c. of defibrinated blood is absorbed from the abdominal cavity of a dog in 24 hours.[50a]) It is uniformly emphasized that fresh blood must be used for autotransfusion, and these are the cases that most urgently need transfusion. But in cases of recurrent bleeding, where fresh blood and old hematomata are found, one can still employ this method. Some of the unfavorable reactions are due to decomposed blood. How long extravasated blood is usable depends on the vitality of the R. B. C. Their products of destruction may be of value in exciting formation of new blood. Lest the blood clot intravenously (a debatable question), the citrate is added or it is defibrinated. Hemolyzed blood is assumed by some not to be harmful.[7] Another advantage claimed more particularly in obstetrical cases is that the blood of antoinfusion brings back into the patient's body her own R. B. C. and serum, which at the end of gestation contain certain products that cause contractions of the uterus.[78] The rectal injection is more applicable in obstetrical cases because of the greater likelihood of contamination of the blood escaping from the uterus. Lichtenstein and Tuffier[79] emphasize that the value of autoinfusion of blood lies not only in the incorporation of a small amount of blood or a large number of R. B. C., but in reincorporating blood and living autogenous, nonhemolytic blood and serum and internal secretions. Placental blood given intravenously to criminals[79] has proved fatal because of the multiple emboli from placental villi, filtered out only partially by

means of many layers of gauze. Rapid injection of placental blood killed animals, slow injection had no effect, another feature favoring intramuscular or rectal injection in obstetrical cases. It is the equivalent of a nutritive rectal injection with favorable absorptive qualities, furthermore containing serum and hemoglobin.[79] One case absorbed 2000 c.c. from a total of 2250 c.c. (saline and blood) injected rectally. The intramuscular employment shortened convalescence perceptibly as the result of stimulation of blood building organs.[72] The quantity of reinfused blood was not material as shown by hemoglobin determinations.[72] Autoinfusion was successfully used in[20] (1) splenic rupture and hemorrhage by Von Peiser and Rauft; (2) liver rupture by Kreuter; (3) gun-shot wounds involving large intraabdominal vessels; (4) wound of the lung by Henschen; (5) ectopics; (6) such obstetrical complications as postpartum hemorrhage, placenta previa, etc. All of the cases fared well, and presumably would have died without this measure. Two or three exceptions are mentioned, notably by Opitz[55] and Albert.[2] The latter had a case which showed cyanosis, pain in the small of the back, hemoglobinuria, and icterus, i.e., all the earmarks of the reaction following transfusion with incompatible blood. This was perhaps due to the fact that the blood had disintegrated too far.

Some of the advantages claimed are: (1) absence of emboli (dependent entirely on the manner of filtration); (2) no hemolysis (which should not occur by using proper test for blood from another individual); (3) sufficient quantity of blood, available at once with no time lost in getting it, (although it will embarrass the operator, when a patient is in critical condition, to prolong the anesthesia in order to make the transfusion into a vein inside the abdomen; donors should be available, especially of Group 4, among the employees of the hospital); (4) testing and grouping not required (it is not as hard as one might infer); (5) there is no need for a Wassermann on the donor.

On the other hand: (1) the blood is not always sterile, even from the abdominal cavity[2] as the odor of colon bacillus sometimes betrays; (2) one never knows how long since the intraabdominal bleeding took place; old blood implies the danger of reaction and might not have any better nutritive value than plain glucose[25] per rectum, or gum-glucose solution intravenously; (3) large quantities of fluid blood are quickly absorbed from the abdominal cavity;[80a] (4) hemoglobinuria and icterus in a few cases are suggestive of hemolysis due to toxin of destruction products of already deteriorating blood; (5) too rapid an injection of blood is necessary if an intraabdominal vein be used and the anesthesia is prolonged unduly; 1200 c.c. have been reinfused within 6 to 8 minutes in one instance,[43] which could predispose to acute cardiac dilatation; (6) on account of the pain caused by the subcutaneous injection it must necessarily be done under anesthesia. Except for the

fact that one has the blood at his immediate disposal in these cases of acute hemorrhage Albert may be right in saying that the procedure has no especial advantages but brings dangers which we should not disregard; especially when the steps of an ordinary transfusion are so simple in competent hands combined with the removal of clots (leaving saline in the abdominal cavity) and the administration of glucose per rectum or intravenously. Furthermore we do not often see fatal ectopic gestations. The majority are doing well even without transfusion, although it is an excellent supplementary measure, because it shortens convalescence and, in cases of postpartum hemorrhage or placenta previa, lessens the tendency to sepsis, to which exsanguinated cases are more susceptible. It is customary now to group placenta previa patients as soon as their condition is diagnosed.

In conclusion it cannot be too strongly emphasized that early transfusion, even at the risk of performing a seemingly needless operation, is far better than waiting until too late as is so often the case, when failure is inevitable. Prophylactic transfusion is becoming more and more employed on account of the harmlessness of it in competent hands.

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GYNECOLOGICAL AND OBSTETRICAL CASE RECORDS

Woman's Hospital in the State of New York
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THE fundamental unit in the development of a hospital record system is the individual case record. Upon its form and the manner in which it is kept depends the usefulness of the system. It is essential, therefore, that all such records conform to the highest standards of scientific record keeping, if the system is to become a source of data which will be of actual value for research purposes.

The standards to which case records must conform will vary slightly with the different branches of medicine. In any case the record will be comprehensive yet simple. It will comply in form with the standards set by the American College of Surgeons, and throughout the terms of the International Terminology will be used. It will contain a complete and accurate record of the case from the initial appearance of the patient at the Out-Patient Department of the hospital until the final visit to the Follow-up Clinic several months or years after operation or treatment. The descriptions of all findings and operative procedures will be conspicuous because of their exactness and completeness, and will convey to the mind of the future reader a clear conception of every phase of the case. It is interesting to note how far short of such an ideal most case records fall.

A careful examination of a large number of case records from the Record Department of the Woman's Hospital and other widely recognized gynecological services has revealed certain common defects which render a large percentage of records practically worthless for scientific purposes. In many instances there have been amazing omissions of salient facts to say nothing of details essential in any form of research. The most noticeable defects are:

1. A lack of suitable record forms upon which to record the facts in the case.

2. A lack of correlation between the records of the Out-Patient Department, Hospital, Pathological Department and Follow-up Clinic.

3. Inadequate histories, the taking of which has been left to the ingenuity of the inexperienced interne, who has not been provided with a definite scheme to follow.

4. Meager and quite meaningless descriptions of physical findings, operative findings, and operative procedures.

5. A lack of carefully recorded "progress" notes by attending and house staff.

6. Incomplete descriptions of the pathological findings.

7. Inadequate notes on the condition of the patient at the time of discharge from the hospital.

8. More or less meager and meaningless descriptions of the follow-up findings.

9. The use of a local rather than the International Terminology.

Cognizant of the importance of the individual case record and the urgent need of a prompt improvement in its quality, the Board of Governors of the Woman's Hospital has made possible during the past year a complete revision of the entire case record system. So satisfactory have been the results that a description of the methods now employed would seem to be justified.

THE FORM OF CASE RECORD

A unit system of case records in which each record is bound and filed singly has been decided upon for the following reasons:

1. It makes possible the giving of one record number to each case regardless of the number of readmissions, and thereby the keeping of all records pertaining to case under one number and one cover.

2. It greatly facilitates research by eliminating the unnecessary handling of irrelevant records, which is inevitable when large numbers of records are bound in volumes.

3. It makes possible the return to the ward of the original complete record should the patient be readmitted at any future time.

4. It makes possible the binding of all case records in the Record Department by a simple method.

RECORD FORMS

A standard size for all record forms has been adopted—that decided upon by The American College of Surgeons—8½" x 11" of the loose leaf type.

To facilitate the recognition of the different record forms several colors of bond paper have been used.

There have been designed for use in recording gynecological cases 20 forms. For obstetrical cases 6 forms have been provided.

GYNECOLOGICAL RECORD FORMS

1. Cover.
2. O. P. D. Reference Record.
3. Personal History.
4. Physical Examination.
5. Clinical Pathology.

6. Urological Record.
7. Gastroenterological Record.
8. Orthopedic Record.
9. X-Ray Diagnosis Record.
10. X-Ray Therapy Record.

11. Consultation Record.
12. Operation Record.
13. Anesthesia Record.
14. Wound Record.
15. Pathological Record.

16. Surgeon's Bedside Notes.
17. Nurse's Bedside Notes.
18. Temperature Chart.
19. Autopsy Record.
20. Summary of Record.

OBSTETRICAL RECORD FORMS

A. Cover.
B. Antepartum Record.
C. Labor Record.

D. Nurse's Bedside Notes—Mother.
E. Nurse's Bedside Notes—Baby.
F. Summary Record.

Fig. 1

In the usual case the above forms with the temperature chart from the gynecologic record constitute the obstetrical case record. If the case becomes complicated, or it becomes necessary to resort to consultations, special clinical investigations and, perhaps, operative

WOMAN'S HOSPITAL IN THE STATE OF NEW YORK

Name

Ward   Room   Bed

Record No.

Referred to Hospital by

Referred for Diagnosis to Dr.

Referred for Treatment to Dr.

Date of Admission

Date of Operation

Date of Discharge

House Surgeon

FORM
1

Face side, Form 1.   Cover.

procedures not purely obstetrical, the gynecologic record forms may be used in conjunction with the obstetrical forms to complete the record.

FILING OF CASE RECORDS ON WARDS

During the stay of the patient in the hospital the record forms pertaining to the case are kept in a standard sized loose leaf note book—9″ x 12″—which is filed in a numbered space—each numbered

RULES FOR CHARTING.

The Record Forms are numbered and must be arranged in the following order both while the record is in the ward and when returned to the Record Department—

1.—Cover
2.—O. P. D. Reference Record
3.—Personal History
4.—Physical Examination
5.—Clinical Pathology
　　Special Clinics' Records
　　　　(If Required)
6.—Urological Record
7.—Gastro-enterological Record
8.—Orthopedic Record
9.—X-Ray Diagnosis Record

10.—X-Ray Therapy Record
11.—Consultation Record
12.—Operation Record
13.—Anesthesia Record
14.—Wound Record
15.—Pathological Report
16.—Surgeon's Bedside Notes
17.—Nurse's Bedside Notes
18.—Temperature Charts
19.—Autopsy Record
20.—Summary

All Records must be printed—not written.

As each record form is added the patient's name and Record Number must be placed at the top of the sheet by the nurse.

NURSE'S BEDSIDE NOTES.

Record in Red Ink:—

(1) Admissions; (2) Discharges; (3) Visits, dressings, examinations and treatments by surgeons; (4) Patient to and from operating room; (5) Midnight dates and lines; (6) Specimens to Laboratory; (7) Recovery Room Notes; (8) Amount of urine passed in first 24 hours after operation.

Record in Black Ink:—

(1) 8 A.M. Charting; (2) Diet, medication and Treatments which must be recorded each time as soon as given, excepting regular diet which is to be charted only in A.M. If for any reason diet, medication or treatment is refused or not given, note must be made of same and reason stated; (3) Results of all Treatments—which must be recorded in detail; (4) Night Charting—same as day.

Sign for Urine—U

Sign for Stool —I

TEMPERATURE, PULSE, RESPIRATION AND BLOOD PRESSURE RECORD.

Record in Red Ink between perpendicular lines:—

(1) Admitted to Ward; (2) After operation; (3) Q. 4 hr. and B.I.D.; (4) All vaginal examinations; (5) Discharged, Transferred or Died.

Record in Black Ink:—

(1) Day of month; (2) Day of Disease until day of operation—after that in red ink.

Reverse Side. Form 1. Cover.

space corresponding to a bed number—in a specially constructed metal desk (Fig. 1).

BINDING OF COMPLETED CASE RECORDS

Upon the completion of the record, the several record forms are sewed together by means of a large sewing machine with which the Record Department is equipped.

FINAL FILING OF CASE RECORDS

Following the binding of the completed case record it is placed in a substantial manila envelope— 9" · 12"—and is filed as a unit upon suitably constructed shelves.

Woman's Hospital in the State of New York

O. P. D. REFERENCE RECORD

Name————————————————————— Address—————————————————————

Referred to Hospital by —————————————————— O. P. D. No.———————Record No.—————

Date of Reference————————————————Date and Hour of Admission—————————————

Length of time under observation in O. P. D.————————————————Age————S. M. W.—————

Came for Relief of———

Chief Points in History———————————————————————————————————————

Previous Operations———

EXAMINATION

Abdomen———

Vulva———————————Urethra————————————Anus and Rectum—————————

Pelvic Floor————————————————————Pelvic Cavity————————————————

Ant. Vaginal Wall ————————————————Post Vaginal Wall—————————————

Cervix Uteri——————————————————Corpus Uteri—————————————————

Right Tube and Ovary————————————————————————————————————

Left Tube and Ovary——————————————————————————————————————

Laboratory Findings, Smears, Wassermann, Urine, Tissue, Cystoscopic and X-Ray Examinations:—————————

Treatment in O. P. D.————————————————————————————————————

Provisional Diagnosis————————————————————————————————————

Additional Remarks: ————————————————————————————————————

FORM
2

Face Side, Form 2. O. P. D. Reference Record.

Woman's Hospital in the State of New York
PERSONAL HISTORY

Name   Address   Record No.

Name and Permanent Address of Friend

Age   S M W   Color   Nationality   Occupation

Outline to be Followed

I CAME FOR RELIEF OF

To be recorded in order of importance
Duration of symptoms

II FAMILY HISTORY

Cancer, Syphilis, Tuberculosis, Nervous
and mental diseases

III PAST HISTORY

1 **Menstrual History.** Type—to be
indicated by | onset periodicity, duration |
Amount   maximum no. of napkins in 24
hrs. Character of flow. Clots. Pain—time
and duration. Date of last regular period.
Date of last period. Menopause

2 **Obstetrical History.** Length of
time married. No. marriages. Living with
husband. No. pregnancies. No. full term
children. Ages. Character of pregnancies,
labors, (injuries and repairs) and puerperia
(fever, duration.) No. abortions. Dates.
Period of gestation. Spontaneous or in-
duced. Curettage. Fever. Convalescence

3 **Previous Illness.** Circulatory,
Respiratory, Urinary, Injuries. Miscellane-
ous. Dates

4 **Previous Operations.** Character.
Dates

5 **Venereal Diseases.** Husband.
Self

IV PRESENT SYMPTOMS

1 **Menstrual.** How changed from
normal. Duration of irregularities

2 **Vaginal Discharge.** Amount,
color, character, odor and time

3 **Pain.** Amount, constancy, character,
location, time and association. Backache—
amount, constancy, character, location,
time and association. Headache—amount,
constancy, character, location, time and
association. Pelvic soreness, bearing down
or dragging sensation in groins, vagina or
rectum. Dyspareunia.

4 **Vaginal Protrusion.** Duration

5 **Abdominal Swelling or Ten-
derness.** Location and duration

6 **Urinary.** Painful, frequent or urgent
micturition. Day or night. Quantity and
character of urine. Control. Retention

7 **Gastro-Intestinal.** Appetite. Di-
gestion. Gas. Relation of gastric distress and
pain to meals. Nausea. Vomiting—time and
character of vomitus. Bowels—control,
regularity, constipation, diarrhea, pain,
blood, mucus, drugs or enema.

8 **Nervous and Mental.** Nervous-
ness—character of. Emotional control.
Flushes. Irritability. Insomnia. Refreshed
or not by sleep. Mental stability

9 **Fever, Chills and Sweats**

10 **General Condition.** Weight,
maximum and present. Loss of Strength

FORM
3

Face Side, Form 3.   Personal History.

Woman's Hospital in the State of New York
PHYSICAL EXAMINATION

Name _____   Record No. _____

Height_____Weight_____Blood Pressure; Systolic_____Diastolic_____Pulse Pressure_____

General Appearance_____ Posture_____

HEAD and NECK

Eyes_____Glands_____Mouth_____

THORAX

Heart_____Mammary Glands_____

Lungs _____

ABDOMEN

Tenderness_____ Rigidity_____ Fat_____

Tumor, Hernia_____ Stomach_____

Intestines_____Liver, Gall Bladder_____Spleen_____

R. Kidney_____ L Kidney_____

EXTREMITIES

Oedema, Varicosities, Reflexes etc. _____

EXTERNAL GENITALS

Labia Majora_____ Labia Minora_____

Introitus_____Clitoris_____

Urethra_____Skeen's Glands_____

Hymen_____ Bartholin's Glands; R._____L._____

Pelvic Floor (Anatomical condition and function of perineal muscles, levator ani and fasciae. State site and extent

of all injuries)._____

_____

_____

_____

FORM 4   Rectum_____ Anus_____

Face Side, Form 4. Physical Examination.

Vagina (Condition Color of mucosa-Discharge)

Anterior Wall _____ Cystocele _____ Urethrocele _____ Length _____

Posterior Wall _____ Rectocele _____ Enterocele _____ Length _____

Cervix Uteri _____ Size _____ Position _____

Shape _____ Consistency _____ Mobility _____

Laceration _____ Endocervix _____ Erosion _____

Dilatation _____ Appearance _____

Discharge-Amount _____ Character _____ Source _____

INTERNAL GENITALS

Corpus Uteri _____ Size _____ Position _____

Shape _____ Consistency _____ Mobility _____

Sensitiveness _____ Remarks _____

Right Tube and Ovary _____

Left Tube and Ovary _____

Cul-de-Sac _____ Parametria _____

PROVISIONAL DIAGNOSIS

Date	Diagnosis	Doctor

Reverse Side, Form 4.   Physical Examination.

Woman's Hospital in the State of New York
CLINICAL PATHOLOGY

Name   Record No.

Urine	Sp. Gr	Reaction	Albumin	Sugar		Sediment and other characters
Date						

Blood	Red Cells	Hgb	White Cells	Polys	Lymph		Other Cells
Date							

Date	Wassermann, Smears, Sputum, Gastric contents, etc.

FORM
5

Face Side, Form 5.   Clinical Pathology.

Woman's Hospital in the State of New York
UROLOGICAL RECORD

Name	Date	Record No

Information Desired

Clinical History

Objective Symptoms

Urethra

Bladder

  Residual

  Capacity

  Appearance of

    Fundus

    Sphincter

    Trigone

    Ureteral Orifices

    Bas-fond

Ureters

  Length

  Calibre

  Urinary flow

    Right side

    Left side

  Pelvic Distention

    (a) Right side

    (b) Left side

Laboratory Findings

  Bladder urine

  Right urine

  Left urine

Phenosulphonepthalein

X Ray Bougies or Collargol

Remarks

FORM
6

Face Side, Form 6. Urological Record

Woman's Hospital in the State of New York
GASTRO-ENTEROLOGICAL RECORD

Name _____ Date _____ Record No. _____

Information Desired _____

Chief G-E Complaints _____

Previous History _____

Previous Operations _____

Obstetrical History _____

Present Illness _____

Physical Examination: Appearance _____ Height _____ Weight _____

Heart _____ Lungs _____

Abdomen _____

Proctosigmoidoscopy _____

Test Meals _____

FORM 7

over

Face Side, Form 7.   Gastroenterological Record.

Woman's Hospital in the State of New York
ORTHOPEDIC RECORD

Name   Date   Record No

Information Desired

Chief Orthopedic Complaints

Duration

Lower Extremities

Feet

Ankles

Knees

Hips

Back

Pain

Contour

Lumbar Index

Irregularities

Abdomen

X-Ray

FORM
8

Face Side, Form 8. Orthopedic Record.

Woman's Hospital in the State of New York
X-RAY DIAGNOSIS RECORD

Name   Record No.

Date   Plate No.

Information Desired

Clinical Diagnosis

Radiographic Report

Radiographer

over

FORM
9

Face Side, Form 9.   X-ray Diagnosis Record.

Woman's Hospital in the State of New York
X-RAY THERAPY RECORD

Name _____ Record No. _____

Date _____ Treatment No. _____

Clinical Diagnosis

Pathological Report

Remarks

Date	Region Treated	Mil.	S G	D	F.	L	Remarks	To Return

FORM
10

Face Side. Form 10. X-ray Therapy Record.

Woman's Hospital in the State of New York
CONSULTATION RECORD

Name   Date   Record No.

Date of Admission   Date of Operation   Surgeon

Information desired from Consultant

Chief Complaints

Points not covered in History

Special Physical Findings

Suggestions for Further Study

Diagnosis

Suggestions on Treatment

                                        Signed

FORM
11

Face Side, Form 11.   Consultation Record.

Woman's Hospital in the State of New York
OPERATION RECORD

Name   Record No.

Surgeon_____ Assistants_____ Suture Nurse_____ Sponge Nurse_____

Date of Operation_____ Started_____ Finished_____ Total Time_____ hrs _____ min.

Preparation_____ By Dr_____ Operating Room_____

Description of Findings and Operation

Woman's Hospital in the State of New York
ANESTHESIA RECORD

Name _____ Record No. _____

Preoperative Medication _____ Time _____

Anesthetic (Nitrous oxide, oxygen, ether, chloroform etc.) _____

Method (open, closed, apparatus etc.) _____

The following points must be noted every 15 minutes throughout Anesthesia.

A. P. M. Time		Anesthetic	Amt.	Pulse	Resp.	Blood Pressure Syst.	Diast.	Medication.	Operative Procedures

Preoperative Blood Pressure: S. _____ D. _____ Postoperative Blood Pressure: S. _____ D. _____

Total Duration of Anesthesia _____ Hrs. _____ Min. Total Amount of Anesthetic _____

Total Duration of Operation _____ Hrs _____ Min. Anesthetist _____

Remarks: _____

FORM 13

13

Face Side, Form 13. Anesthesia Record.

Woman's Hospital in the State of New York
WOUND RECORD

Name   Record No

ABDOMINAL, LUMBAR or BREAST WOUNDS

Site   Operation   Date

Was wound contaminated at time of operation?

Drainage   Removed on   By Dr

Number of Removable Sutures   Removed on   By Dr

Wound Healed by   Cause of Failure to unite by Primary Union

Condition of Wound on Discharge   Surgeon

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

VAGINAL WOUNDS

Site   Operation

Drainage   Removed on   By Dr.

Number of Removable Sutures   Removed on   By Dr.

Wound Healed By   Cause of Failure to unite by Primary Union

Condition of Wound on Discharge   Surgeon

Date	Condition of Wound	Organisms	Character of Dressing	Dressed By

FORM 14

Record Additional Dressings on Reverse Side of Sheet

Face Side. Form 14. Wound Record.

Woman's Hospital in the State of New York
PATHOLOGICAL RECORD

Name   Record No.

Specimen Received   Path. No.

                                                                        Date

                                                                        Ward

                                                                        Surgeon

Findings:

Diagnosis

Pathologist

Face Side, Form 15.   Pathological Record.

Woman's Hospital in the State of New York
SURGEONS' BEDSIDE NOTES

Name _____   Record No. _____

Date	Hour	Notes	Doctor

FORM
16

Face Side. Form 16. Surgeon's Bedside Notes.

Woman's Hospital in the State of New York
NURSES' BEDSIDE NOTES

Name   Record No

Hour A.M. P.M.	Diet, Medication and Treatment	Urine	Stools	Condition of Patient, Effect of Medication and Description of Excreta

FORM 17

Face Side, Form 17. Nurses' Bedside Notes.

Woman's Hospital in the State of New York
Temperature, Pulse, Respiration and Blood Pressure Record

Mouth Temperatures are to Be recorded by ·
Rectal Temperatures are to Be recorded by x

Face Side, Form 18. Temperature, etc., Record.

Woman's Hospital in the State of New York
AUTOPSY RECORD

Name

Record No.

Date

FORM
19

over

Face Side, Form 19. Autopsy Record.

Woman's Hospital in the State of New York
SUMMARY OF RECORD

Name   Record No.

1. Came for Relief of

2. Provisional Diagnosis   3. Operations or Treatment by Dr

4. Pathological Diagnosis   5 Complications

6. Recovery   7 Final Diagnosis

8. Is the patient relieved of all symptoms present at the time of Admission?

9. If not relieved, which symptoms remain?

10. Have new symptoms developed while in the hospital?

11. Physical Condition upon Discharge

12. Prognosis

13. Points to be especially noted in Follow-up

14. Treatment advised after Discharge

15. Referred to _____ clinic for Treatment   History approved by

16. Date of Discharge _____ By Dr

17. Date of Transfer _____ To

18. Date and Hour of Death _____ Cause of Death

FORM
20   Note:. Lines 1 and 8 to 18 inclusive, must be filled in at time of Discharge by the Surgeon responsible for the case.

Face Side, Form 20. Summary of Record.

WOMAN'S HOSPITAL IN THE STATE OF NEW YORK

OBSTETRICAL DEPARTMENT

Name ....

Ward .... Bed .... Room ....

Record No. ....

Referred to Hospital by ....

Referred for Treatment to Dr. ....

Date of Admission ....

Date of Delivery ....

Date of Discharge ....

Resident Obstetrician ....

Ob. form
A

Face Side, Obstetrical Form A.   Cover.

RULES FOR CHARTING

The Record Forms must be arranged in the following order both while the record is in the hand and when returned to the Record Department

Cover	Labor Record
Ante Partum Record	Operation Record
Clinical Pathology	Anesthesia Record
Special Clinics' Records (If Required)	Wound Record
	Pathological Report
Urological Record	Surgeon's Bedside Notes
Gastro-enterological Record	Nurse's Bedside Notes (Mother)
Orthopedic Record	Nurse's Bedside Notes (Baby)
X-Ray Diagnosis Record	Temperature Charts
X-Ray Therapy Record	Autopsy Record
Consultation Record	Summary

All Records must be printed—not written.

As each record form is added the patient's name and Record Number must be placed at the top of the sheet by the nurse

NURSE'S BEDSIDE NOTES

Record in Red Ink:—

(1) Admission; (2) Discharges; (3) Visits, dressings, examinations (except labor room examinations) and treatments by surgeons; (4) Patient to and from operating room; (5) Delivery; (6) Midnight dates and lines; (7) Specimens to Laboratory; (8) Recovery Room Notes; (9) Amount of urine passed in first 24 hours after operation.

Record in Black Ink:—

(1) 8 A. M. Charting, including condition of Breasts, fundus and lochia; (2) Diet, medication and Treatments which must be recorded each time as soon as given, excepting regular diet which is to be charted only in A. M. If for any reason diet, medication or treatment is refused or not given, note must be made of same and reason stated; (3) Results of all Treatments—which must be recorded in detail; (4) Night Charting—same as day

Sign for Urine—U   Sign for Stool—I

TEMPERATURE, PULSE, RESPIRATION AND BLOOD PRESSURE RECORD

Record in Red Ink between-perpendicular lines:—

(1) Admitted to Ward; (2) After operation; (3) Delivery; (4) Q. 4 hr. and B. I. D.; (5) Discharged, Transferred or Died

Record in Black Ink:—

(1) Day of month; (2) Day of Disease until day of operation—after that in red ink

BABY RECORD

Record in Red Ink:—

(1) Argyrol installation on 3rd Day; (2) Cord inspection on 5th and 10th Day; (3) Retraction of prepuce on 7th Day. (4) Circumcision; (5) Day Post Partum and weight

Record in Black Ink:—

(1) Formulae, medication and Treatment; (2) Results of all treatments; (3) All other regular charting.

Reverse Side, Obstetrical Form A. Cover.

Woman's Hospital in the State of New York
ANTE PARTUM RECORD

Name _____ Probable Date of Labor _____ Record No. _____

Address _____ Age _____ Nationality _____ S. M. W _____ Para _____

Family History (Tuberculosis, Syphilis, Multiple Birth, etc.) _____

Personal History (Rickets, Syphilis, Tuberculosis, Gonorrhea Pelvic, Heart, Lung and Kidney Disease, Operations) _____

Menstrual History: Began _____ Type _____ Duration _____ Amount _____ Pain _____

Date of last regular period _____ Date of last period _____

Obstetrical History: Abortions–before 28th week (No. Spontaneous, Induced. Week of Gestation. Dates) _____

Spontaneous Premature Labors: (No. Week of Gestation. Date, Cause) _____

Previous Full Term Pregnancies: No. normal _____ No. abnormal (Complications) _____

Previous Labors: Dates _____ No. induced (Indications) _____

No. Spontaneous Deliveries _____ No. Operative Deliveries (Indications) _____

Duration of Labors _____ Presentations: Cephalic _____ Breech _____ Transverse _____ Multiple _____

Weights of Babies _____ No Still Births _____ Causes _____

Previous Puerperia _____

Present Pregnancy _____

External Examination

Date _____ Made by Dr _____ General Condition _____ Height _____ Wt _____

Lungs _____ Heart _____

Deformities _____ Oedema _____

Mammary Glands _____ Gland Tissue _____ Nipples _____ Colostrum _____

Abdomen _____ Uterus _____

Fetus: Size _____ Presentation _____ Position _____ Presenting Part-(Above, In, Below) Brim

Heart-Location _____ Rate _____ Loud or Faint _____ Fetal Movements _____

External Measurements

Interspinous _____ cm. Intercrestal _____ cm. External Conjugate _____ cm. R. Oblique _____ cm. L. Oblique _____ cm.

Transverse Diam. Outlet _____ cm Ant-Posterior Diam. Outlet _____ cm.

Posterior Sagittal Diameter _____ cm. Pubic Arch _____

Ob. form
B

Face Side, Obstetrical Form B. Ante Partum Record.

Internal Examination

Introitus_____ Urethra_____ Bartholin Gland R_____ L_____

Pelvic Floor Intact Lacerated Relaxed_____

Vagina Cystocele Entrocele Rectocele Congenital Defects_____

Cervix Position_____ Laceration_____ Int os_____ vaginal_____

Appendages R_____ L_____ Pelvic Cavity_____

Internal Measurements

Diagonal Conjugate_____ in True Conjugate_____ cm Depth of Symphysis_____ cm

Sacrum (Abbreviation)_____ Ischial Spines_____ Coccyx_____

Remarks_____

Wasserman_____ Taken_____ 19____ Smears_____ made_____ 19____

Subsequent Ante Partum Examinations

Date	Presentation Position	Head	Fetal Heart	Fundus	Cervix	Urine	B. P.	Notes	Doctor

Remarks_____

Signed_____

Reverse Side, Obstetrical Form B. Ante Partum Record.

Woman's Hospital in the State of New York
LABOR RECORD

Name _____ Record No. _____

Admitted to Hospital _____ A. P. M. _____ 192 ____ Before-In _____ Stage of Labor

General Condition _____ T. _____ P. _____ R. _____ Fetal Heart _____

Membranes ruptured-artificially-spontaneously. _____ Hours before - after _____ onset of Labor.

Condition of cervix at time of rupture of membranes _____ Liquor amnii _____

Was Labor Induced? (Give indication and method) _____

First Stage

Began at _____ A. P. M. _____ 19 ____ Ended at _____ A. P. M. _____ 19 ____ Duration of 1st Stage _____ Hrs. _____ Min.

Character and frequency of pains _____ Fetal Heart _____

Fetus: Presentation _____ Position _____ Level of Presenting Part _____

Abnormalities _____

Second Stage

Began at _____ A. P. M. _____ 19 ____ Ended at _____ A. P. M. _____ 19 ____ Duration of 2nd Stage _____ Hrs. _____ Min.

Character and frequency of pains _____ Fetal Heart _____

Fetus: Presentation _____ Position _____ Level of Presenting Part _____

Abnormalities _____ Cord about Neck? _____ - _____ Spontaneous - Operative Delivery.

Third Stage

Began at _____ A. P. M. _____ 19 ____ Ended at _____ A. P. M. _____ 19 ____ Duration 3rd Stage _____ Hrs. _____ Min.

Placenta: Normal Delivery? _____ Artificial Method Employed _____ Complete? _____

Membranes: Complete? _____ Amount Retained? _____ Cord (Length-Abnormalities) _____

Hemorrhage: Source _____ Amount ____ o c. Treatment _____

Condition of Pelvic Floor _____ Condition of Cervix _____

Abnormalities _____ Total Duration of Labor _____ Hrs. _____ Min.

Anesthetic given by _____ Anesthetic _____ Given from _____ A. P. M. to _____ A. P. M. Total time _____

Delivered by Dr. _____ Assisted by Dr. _____ Charge Nurse _____ Suture Nurse _____

Ob. form C

(over)

Face Side of Obstetrical Form C. Labor Record.

Examinations During Labor

Date	Time	Vaginal Rectal	Presentation Position	Level of Presenting Part	Condition of Cervix Thick Thin Rigid Soft Amount of Dilatation	Pains Character Frequency	Membranes Intact Ruptured	Fetal Heart	Examiner

Medication During Labor

Date	Time	Stage	Medication	Date	Time	Stage	Medication

Operative Procedures

Indications _____

Description of operation _____

_____

_____

_____

_____

One Hour Post-partum. T _____ P _____ R _____ B.P _____ Height of Fundus _____ Lochia _____

Record of Child

Living Still-Born Macerated General Condition _____ Sex _____ Maturity _____ Weeks. Wt _____ Lbs _____ oz.

Circulation { Anemic Cyanotic Normal } Respiration { Artificial Spontaneous } Asphyxia { Slight Moderate Marked } Cause _____

Treatment of Asphyxia (Time required) _____ Defecated? _____ Micturated? _____

Caput { Size Location } _____ Moulding _____ Congenital Defects _____

Circumferences: Suboccipito-Bregmatic _____ cm Occipito-Frontal _____ cm Total Length _____ cm

Diameters: Biparietal _____ cm Suboccipito-Bregmatic _____ cm Occipito-Ment _____ cm Occipito Frontal _____ cm

Woman's Hospital in the State of New York
NURSES' BEDSIDE NOTES
Mother

Name'   Record No.

Date	Day	Notes	Urine	Stools	Treatment
		Breasts			
		Fundus			
		Lochia			
		Breasts			
		Fundus			
		Lochia			
		Breasts			
		Fundus			
		Lochia			
		Breasts			
		Fundus			
		Lochia			
		Breasts			
		Fundus			
		Lochia			
		Breasts			
		Fundus			
		Lochia			
		Breasts			
		Fundus			
		Lochia			
		Breasts			
		Fundus			
		Lochia			
		Breasts			
		Fundus			
		Lochia			

Ob. form
D

Obstetrical Form D.   Nurses' Bedside Notes (Mother).

Woman's Hospital in the State of New York
NURSES' BEDSIDE NOTES
Baby

Name _____   Record No. _____

Date of Birth _____   Hour _____   A. P. M. Sex _____   Birth Wt _____   Delivery _____

General Condition when admitted to Nursery _____

Date	Day	Lbs	oz.	Temp	Def	Treatment	Notes
				A. M.			
				P. M.			
				A. M.			
				P. M.			
				A. M.			
				P. M.			
				A. M.			
				P. M.			
				A. M.			
				P. M.			
				A. M.			
				P. M.			
				A. M.			
				P. M.			

Ob. form
E

Obstetrical Form E. Nurses' Bedside Notes (Baby).

Woman's Hospital in the State of New York
SUMMARY OF RECORD
OBSTETRICAL DEPARTMENT

Name _____ Record No. _____

EXAMINATION ON DISCHARGE
Mother

Date _____

Breasts _____ Nipples _____ Abdominal Wall _____

Pelvic Floor _____ Ant. Vaginal Wall _____ Post. Vaginal Wall _____

Cervix _____ Uterus: Position _____ Involution _____ Mobility _____

Lochia _____ Appendages and Parametria _____ General Condition _____

Baby

Eyes _____ Breasts _____ Umbilicus _____

Genitals _____ Anus and Buttocks _____ Skin _____

Wt. ____lbs.____oz. Artificial Feeding _____ General Condition _____

Examined by Dr. _____

1. Final Diagnosis   2. Operations

3. Complications   4. Pathological Diagnosis

Points to be especially noted in Follow-up _____

Treatment after Discharge _____

Referred to _____ Clinic for Treatment _____

Date of Discharge { Mother / Baby _____ By Dr. _____

Date of Transfer { Mother / Baby _____ To _____

Date and Hour of Death { Mother / Baby _____ Cause of Death _____

Prognosis for Future Child Bearing _____

Ob. form
F

Delivered by Dr. _____ History Approved by Dr. _____

Obstetrical Form F. Summary Record.

A METHOD OF KEEPING FALLOPIAN TUBES OPEN*

By WILLIAM T. KENNEDY, M.A., M.B., (Tor.)

Junior Attending Surgeon

INTRODUCTION

THE insufflation of the fallopian tubes with CO_2 gas as done by Rubin[1] has led to the detection of obstructions which produce sterility. After the diagnosis of occluded tubes has been established and there is no evidence of acute or subacute salpingitis, a laparotomy is done, adhesions about the fimbriae of the tubes are separated, and a resection of either tube is done when necessary. Some material is now required to preserve the patency of the tubes. Huber[2] experimentally has observed the superiority of alcoholized tissue in nerve surgery. For some time I have used Cargile membrane hardened in alcohol for at least 48 hours, threading it through the fallopian tubes and the cavity of the uterus to keep these tubes open both into the uterine cavity
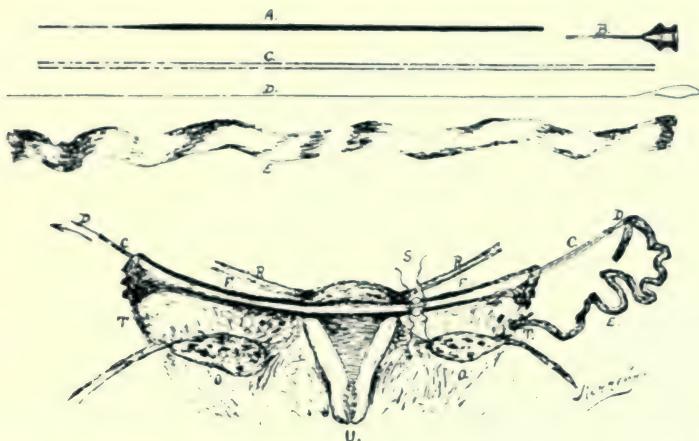
Fig. 1.—A, silver probe—length about 10 cm.; diameter .75 mm. to 1.00 mm., having a bristle about .45 mm. in diameter mounted in one end. B, cannula to attach a Luer hypodermic syringe at one end and a hollow probe C at the other. C, hollow silver probe—length about 25 cm., diameter the same as A. D, strand of piano wire about 3 cm. longer than C, looped at one end to serve as a membrane carrier. E, strip of Cargile membrane about 40 cm. long and 3 cm. wide. F, Fallopian tubes. U, uterus. O, ovary. R, round ligament. T, point of attachment of one end of the membrane. S, plastic sutures to anastomose the excised ends after a resection.

and into the peritoneal cavity. The membrane is flexible and strong, nonirritating to the contact tissues and is slowly absorbed, giving all raw surfaces time to heal and allowing this part of the genital tract to remain patent.

The accompanying diagram (Fig. 1) illustrates the apparatus used and the method of procedure.

The Probe *A* is passed down the fallopian canal. The bristle enters first the isthmus of the tube, then the uterine cavity, directs the probe and makes the canal large enough to allow the passage of Probe *C*. Probe *A* is now removed and used to treat the other tube in the same manner. If there are any signs of an old inflammatory process each fallopian tube can be slowly irrigated from the fimbria into the uterine cavity with alcohol, using the Luer syringe attached to *B* and *C*. If for any reason the resection of a part of either tube is found necessary, that should now be done. Then thread Probe *C* through one fallopian tube, the cavity of the uterus, and the other fallopian tube as illustrated. Insert and tie all plastic sutures, *S* with *C* in position, to eliminate any possible obliteration of the canal. Now insert *D* into *C* and thread *E* on the wire loop, withdraw *C*, *D* and *E* together and leave the membrane through this part of the genital tract. Thread one end of the membrane on a round needle, pass it through the portion of the broad ligament at *T* and ligate it. Fasten the other end in the same manner to the other broad ligament at *T*. This will leave a loop of the membrane in the peritoneal cavity at each side to accommodate a possible pregnancy before the membrane becomes absorbed.

All cases diagnosed as acute or subacute salpingitis must wait at least six months and the treatment of any such cases not suspected on diagnosing, but so found by laparotomy, must be postponed. The procedure takes from 10 to 30 minutes. Accessory, malposition and other pathological conditions are treated when indicated.

REFERENCES

(1) Jour. Am. Med. Assn., lxxv, 661. Am. Jour. Roentgen., March, 1921, p. 120. (2) Surg., Gynec. and Obst., May, 1920, p. 464.

163 EAST SIXTY-FIRST STREET.

THESES CONTRIBUTED BY UNDERGRADUATE FOURTH
YEAR STUDENTS AS PART OF THEIR WORK AT
THE WOMAN'S HOSPITAL IN THE DEPART-
MENT OF GYNECOLOGY, CORNELL
UNIVERSITY MEDICAL COLLEGE
SERIES 1922

GUM-GLUCOSE IN THE TREATMENT OF SURGICAL SHOCK

A Study of the Action of Gum-Glucose Solution Intravenously in 53 Cases

By Ainsworth L. Smith, A.B., M.D.

Fourth year student, Cornell University Medical College

THE purpose of this paper is to discuss the results obtained in a series of 51 operative cases that received gum-glucose injections intravenously as a prophylactic against surgical shock or in the treatment of that condition. However, in order to have a foundation for this discussion, it seems better to give an introductory statement of the theory of shock upon which gum-glucose therapy rests.

Surgical shock gives a distinct clinical picture characterized by collapse; pallor; a profound fall in blood pressure; and a disturbance of the heat regulating mechanism so that the patient is covered with a cold, clammy sweat. There is an "acidosis" as indicated by a lowered CO_2 combining power of the plasma; and a concentration of blood corpuscles (red) in the peripheral capillaries, e.g., a blood count made from the finger-tip gives a high reading (8 million); and with this concentration there is an increased viscosity of the blood, up to 7 or 8 (normal about 4.5).

The cause of shock as described by Bayliss after observations on wounded men and experiments on cats, is apparently a combination of factors, "some nervous, some chemical, cold and trauma, each associated with a fall in blood pressure and all exaggerated by hemorrhage, resulting in a state of collapse." "Along with hemorrhage the most serious of these collateral causes is the absorption of toxic products from injured tissue especially muscle. These products appear to have a dilator action on the capillaries, an action allied to that of histamine. Blood is hereby withdrawn from circulation and held up by stasis." the plasma filters out of the vessels and the blood thus tends to become concentrated, giving the increased viscosity.

There are many other theories of shock, notably "Nerve center exhaustion," "Dilatation of splanchnic vessels," "Adrenaline exhaustion," etc. These are merely mentioned in passing and cannot be discussed here except to say that adrenaline exhaustion is disproved by blood analysis and that in laparotomies that have gone into shock on the table no dilatation of the splanchnic arterioles has been seen (Bayliss).

The theory of capillary dilatation caused by tissue toxins will account for the symptoms, i.e., is mechanically possible, and is supported by experimental evidence. For example a cat may be sent into shock

by hammering the thigh muscles and the collapse is much greater if there has been previous hemorrhage. However, if the limb is centrally ligated before hammering there is no shock, although the nerves are intact, until the ligature is removed and the circulation restored, whereupon the blood pressure immediately falls and the other signs of shock supervene.

But whatever it is that causes the fall in blood pressure, the fall itself is a most serious factor. Tissue oxygenation is dependent on the supply of corpuscles per minute, i.e., upon the minute supply of blood, leaving out the factor of anemia. This minute supply is dependent on arterial pressure which in turn is dependent on 1. the strength of the heart, 2. the size of the arterioles, and 3. the blood volume. The heart does not fail primarily in shock, and there is no dilatation of the arterioles as observed on the splanchnics and as indicated by the pallor of the skin. But there is a fall in blood pressure which must therefore be due to a decreased blood volume. This is accounted for by the dilated capillary field with stasis and concentration. The method of concentration will be considered in a moment. A large proportion of the blood is thus lost to the circulation, a condition called by Cannon an "exemia."

Cannon showed that on a perfused organ a fall in arterial pressure of 1/3 its total, as from 150 to 100 mm., gave a decrease minute volume flow of 2/3, the supply failure being more than proportional to the first drop in pressure. Thus it follows that in shock with its large fall in blood pressure there is a correspondingly greater fall in the tissue blood supply, and as a corollary, tissue oxygenation.

Bayliss states that the tissue toxins responsible for shock are destroyed by oxidation as well as elimination. Likewise our present theory of acidosis is an incomplete oxidation of fats, and strong support of this theory is found in Cannon's work on alkali reserve in shock (1917). It was long known clinically that shock patients had a low CO_2 plasma combining power but Cannon showed that the decrease was roughly proportional to the fall in blood pressure.

Systolic Blood Pressure	Average CO_2 Combining Power of Plasma
Above 80	49 plus
70—80	43
60—70	35
below 60	27

He concludes that if the systolic pressure does not rise above 80 mm., measures should be taken to raise it by intravenous injection.

In addition to being oxidized, toxins and acetone bodies are eliminated by the kidneys but renal output is also roughly proportional to the blood pressure; a severe shock may have a complete anuria.

Lastly when oxygenation is seriously impaired the body cells are injured. The liver cells may fail in their detoxicating function, and nerve cells are particularly sensitive. If the low blood pressure has lasted a certain length of time, which varies with the degree of anemia, the vital centers fail. If the circulation is improved at once they may recover, otherwise the victim dies. This has been shown experimentally with cats by Bayliss.

To recapitulate.—The essential element in shock, however caused, is the fall in blood pressure with consequent decreased tissue oxygenation, resulting in

1. Production of tissue toxins.
2. Production of acidosis, as indicated by a decreased alkali reserve.
3. With decreased renal elimination and probably impaired liver function.
4. With final paralysis of the nerve centers.

Hemorrhage with its loss of corpuscles of course aggravates the difficulties of oxygen transport.

This theory has been taken up at some length to indicate why the essential part of shock therapy is improved circulation through improved blood volume. Unless there has been severe hemorrhage or anemia there are plenty of corpuscles still in the body, but stagnant and out of currency. If there has been hemorrhage a blood transfusion is of course indicated, otherwise means to increase the plasma. Why use a gum solution for this and not saline?

Physiologic saline was the natural solution to try in this state but clinically it was found that although the blood pressure did rise following its intravenous injection the rise lasted only 30 minutes to an hour. The reason for this is evident on a little analysis. The capillary walls are semipermeable membranes, permeable to fluid and crystalloids but not to colloids. Fluid is held in the circulatory system by osmotic pressure which holds it against the filtration force of the arterial pressure. Also filtration is somewhat dependent on the rate of flow. With capillary dilatation and slowing, the fluid escapes even though the blood pressure falls and continues to escape until only that held back by the osmotic pressure of the colloids remains. The crystalloids diffuse through so that their osmotic pressure is equal on both sides. The blood is thus concentrated. This is an exaggeration of the normal lymph production. When saline is injected the blood pressure is raised at once but the salt diffuses through the capillaries and equalizes the osmotic pressures. Since the increase in blood pressure increases the filtration pressure the extra fluid is quickly forced out. Also since the saline has diluted the blood the colloids are of course diluted and so exert less osmotic pressure until the blood is again concentrated. Experimentally Gasser and Erlanger found by

studying the blood pressure and viscosity of blood that after any crystalloid as saline, glucose, or bicarbonate solution the blood pressure rose only one-half of its theoretical maximum and the rise was maintained, on the average, only 5 to 45 minutes. Further, not only is the saline of little value but large amounts are actually dangerous—the filtering out of the fluid gives edema of the tissues (often seen in a perfused organ) and large volumes clinically have produced edema of the lungs.

Thus it will be seen that a colloid is necessary to hold fluid in the circulation. Experimentally gum acacia has been shown to be the most practical (Bayliss). It is chemically inert, nontoxic, easily obtained and sterilized. It is a combination of a pentose, arabinose, and galactose, both carbohydrates nonharmful to the organism. In a 6 per cent solution in saline gum has the same viscosity as blood and so does not dilute it. The gum exerts a high osmotic pressure which it maintains for some time since it cannot permeate the capillary walls. Experimentally the effect lasts about 6 hours. It is finally oxidized as a carbohydrate and disappears from the circulation. It is claimed that it hemolyzes red cells but in the cases reported the gum was dissolved in distilled water, not saline. In water the osmotic pressure of the colloid is not sufficient to prevent hemolysis but in saline the crystalloid protects the reds and the colloid exerts its additional osmotic pressure without effect on the red cell. It has also been claimed that gum causes agglutination of the red cells, and thrombi, but those cases reported have been where the gum was used in 25 per cent solution, entirely too viscid and mucilaginous. In the strength of 6 per cent as recommended by Bayliss no hemolysis or agglutination has been found *in vitro*. Cells do settle to the bottom of a tube of 6 per cent gum just as they do in saline, but this is not agglutination as they are readily diffused again by shaking; this sedimentation could not happen *in vivo*. Hypertonic gum solution (25 per cent) has been used with the idea of attracting more fluid into the circulation, but it has been found experimentally that gum attracts fluid slowly. Gasser and Erlanger found that it took 25 to 50 minutes for the blood to attain its maximum dilution. Hence to add mucilage to an already concentrated blood might well be clinically dangerous.

The danger is lessened if the gum is injected very slowly and is entirely obviated if a crystalloid as 20 per cent glucose is added to the gum saline. The crystalloid attracts the fluid quickly and the gum holds the increase. Thus the blood pressure is raised not only by the fluid injected but also by fluid attracted from the tissues, it rises quickly and is well maintained. In experimental work carried out at Woman's Hospital the gum glucose combination was found

absolutely innocuous in rabbits. Rabbits were sent into shock and the mesentery exposed. Gum-glucose was given and the blood pressure rose and was maintained. The mesenteric capillaries were watched through a microscope but no agglutination was observed.

The reason that glucose was added to the gum saline mixture was not merely for its crystalloidal effect but to combat acidosis on the theory that "fats burn in the fire of carbohydrate." The question of the part played by acidosis in shock is a large one and cannot be gone into in detail. However it is known that CO_2 combining power is lowered as stated above and hence an acidosis of some kind must be admitted and treated. The question of bicarbonate of soda in place of glucose as therapy for acidosis is complex. Present theories are tending away from the idea that acid *per se* is responsible for the symptoms but rather that some concomitant "toxin," probably an incompletely oxidized catabolite of fat metabolism is the cause. Thus Joslin's treatment of impending coma is eliminative, forcing fluids. But assuming that incomplete oxidation is responsible, is it not more logical to supply more oxygen to the tissues, as gum does by its improvement in circulation in shock, (not speaking of diabetes here) at the same time supplying the carbohydrate fuel, rather than by alkali to neutralize the acid stimulation of the respiratory center? In fact alkali has been found clinically dangerous in diabetic coma and Joslin for example has discontinued its use.

It may be argued that there is no lack of blood sugar in shock, indeed there may be an actual increase. Tatum concluded after experiments on cats that there was a protective mechanism on the part of the liver in throwing out carbohydrate to combat acidosis in shock. Be that as it may, the body will take care of the amount of glucose given in the injections as will be shown in a minute. But even if an excess should be given the result is still beneficial since glucose is a diuretic and hence improves the elimination of all these various hypothetical toxins. Glucose likewise has a distinct nutritive value and possibly a specific tonic effect on the heart muscle.

Woodyatt has shown that the body can utilize glucose without any glycosuria if it is injected no faster than 0.8 gm. per kg. of the body weight per hour. This averages about 4 c.c. of the 20 per cent solution per minute in the average size patient. This brings in another factor in the gum-glucose administration. The slow rate is an advantage in any intravenous work, there is no overburdening of the heart. The solution is of course given at body temperature.

If these conditions are followed out, sterile, pure gum acacia, 6 per cent solution in saline, plus glucose to 20 per cent, injected not faster than $4\frac{1}{2}$ c.c. per minute, at a temperature of about 100° F. at the needle (about 105° in the container), a marked rise in blood pres-

sure should take place with clinical improvement lasting about 6 hours (when the injection may be repeated), and without any deleterious effects.

INDICATIONS

1. *Shock.*—The theory has been discussed; the main point is to give the gum glucose early before the vital centers are damaged.

2. *Hemorrhage.*—Gum-glucose cannot replace corpuscles but it makes for a better utilization of the remaining corpuscles. Therefore gum glucose which can be kept ready prepared is invaluable in tiding the patient over that critical period until a donor is found and the patient finally transfused.

3. *Prophylactic.*—As indicated in the early discussion shock is a progressive thing—a sort of vicious circle. Something, Bayliss says tissue toxins, causes a fall in blood pressure which results in the production of more toxins and acidosis through incomplete oxidation. Therefore the rational therapy is early therapy, when the blood pressure starts falling. Gum will maintain B.P. for some hours and hence in selected cases is a real prophylactic.

Surgical judgment must determine the cases susceptible to shock. This is, of course, frequently impossible but there are some guides.

Gum-glucose will help in the following cases:

1. The puny, nonresistant type, anemic and rundown.

2. The fat, flabby, "poor operative risk."

3. The case with very low blood pressure (preoperative) that cannot stand much further drop.

4. The case with very high blood pressure that starts to fall fast, remembering that a $\frac{1}{3}$ drop in pressure is serious.

5. The case that preoperatively has a low alkaline reserve.

6. Cases with very large abdominal tumor masses, as ovarian cysts, where there may be a sudden release of intraabdominal tension with profound fall in blood pressure.

7. In any case where the operation is going to be very long or very radical.

In short, gum-glucose should be used as a factor in the problem of operation versus resistance.

WHEREIN MAY GUM-GLUCOSE FAIL?

Gum-glucose is no panacea, some bad operative risks will go into shock in spite of everything.

In severe hemorrhage gum is but a temporary expedient.

In severe shock where gum is given late the nerve centers are already injured. Further there is some experimental evidence that in long continued shock the capillary walls are injured and become per-

meable to colloids of even large molecules. The remedy is of course prophylaxis.

One danger must be remembered in prophylactic injections. Hemorrhage is increased by high blood pressure. In the course of the operation more blood may be lost than the surgeon realizes since the pulse remains good due to the gum, but a few hours later when the gum effect is gone the patient, presumably a poor risk to start with, is in bad shape. And the surgeon does not realize that a transfusion is now indicated and not more gum-glucose alone. This has accounted for several gum "failures" but the fault was only in the hemostasis.

This then is the theory of gum-glucose therapy. The following is an analysis of the actual effect of gum glucose as seen in a series of 53 cases at Woman's Hospital. These cases range in time from May, 1920, to March, 1922. Probably twice this number of cases received gum during this period but charts for cases in 1921 were not available in the bindery. A series of over 100 cases has been reported previously by Dr. Lilian K. P. Farrar showing good results. The findings in the present series starting with the less important are as follows:

1. *The Urine Output* in the first 24 hours following gum-glucose intravenously.

When glucose is in excess in the blood it is a diuretic and as all these patients received a Murphy drip in addition to the intravenous injection it is with some surprise that one finds that the average output of these 53 cases was only 17.2 oz. with a maximum of 40 in one case, while 31 controls picked at random but nearly all of whom also received Murphy drips, showed an average of 19.2 oz. (with a max. of 34) in the first 24 hours postoperative. The explanation is fourfold.

a. The technic of the glucose administration is planned to give no excess. These results indicate that the body can utilize the glucose as given.

b. It might be suggested that the osmotic pressure of the gum hindered renal filtration. This is highly improbable.

c. Two of the cases died with practically no urine output. If these be ruled out the average of the others is found to be 20 oz., i.e., more than the controls.

d. Almost half the cases were in shock before the gum was given and hence had a low blood pressure with resultant low kidney function. Analyzing the shock and prophylactic cases separately, the prophylactic cases including those that later went into shock put out over 20 oz., while the actual shock cases excreted only 14 oz. When it is remembered that severe shock has almost an anuria these 14 oz. represent quite an effect of the gum-glucose. This result is

due chiefly to the rise in blood pressure plus the diuretic effect of the glucose in a few cases where it was in excess.

Taking the whole series together it will be noted that these poor risk patients put out practically as much urine as the controls (17 and 19 oz.), a distinctly beneficial influence.

2. *Influence on Postoperative Vomiting.*—On the theory that some of the postoperative vomiting is partly a toxic symptom, gum-glucose should lessen it. This was found to be the case in the series as a whole. The thirty-one controls vomited on the average of 2.8 times each postoperative, while in 51 gum cases the average postgum vomiting was only 1.3 times. On closer analysis the difference is not so marked. Profound shock itself gives such complete collapse that there is almost no vomiting. Thus the shock cases and deaths lower the average. To note the effect of gum-glucose, only cases that did not go into shock should be considered. There were 23 such cases and in them the average vomiting was 2.4 times, still somewhat lower than in the controls (2.8). The difference is not marked enough to draw definite conclusions but it indicates a helpful tendency on the part of the gum remembering that these were the poor risks or that the operation was unusually long and severe.

There were two cases of persistent vomiting where gum-glucose was given purely as nutrition. Case No. 26 had returned to the ward in good condition postoperative but developed vomiting that persisted for three days in spite of gastric lavage. Glucose was given intravenously 4 times in the three days to a total of 1150 c.c. for nutrition and to prevent desiccation. The glucose provided the nutrition. No food was taken by mouth during these three days but the patient maintained her strength. Vomiting stopped on the fourth day and the patient recovered uneventfully.

The other patient (case 31) had difficulty with the gum-glucose. After 250 c.c. of the first injection she had such a violent chill that the administration had to be stopped. Nutrition was later given by plain glucose by hypodermoclysis (gum of course as a colloid is contraindicated for this latter method). This case will be discussed later under the "unfavorable results."

It is interesting to note that in Case 26 above, where the injections average 300 c.c. but where the blood pressure was not low, the gum did not raise the pressure more than an average of 5 points (maximum 9). Apparently gum has less effect on normal blood pressure than when it is abnormally low as in the cases that follow.

3. *The Effect of Gum-glucose on Blood Pressure.*—This is a very important result to study since the blood pressure is a rough index of the severity of shock and to raise it was the main aim of gum therapy. The records are unfortunately incomplete. The blood pres-

sure should have been recorded before and after the gum injections and also two hours after to note maintenance.

In 41 cases where any blood pressures are recorded only 16 have a complete record. Nineteen have no 2-hour record and 6 have the 2-hour but no immediate postinjection record. However these are totaled together as follows (systolic pressures):

> a. Results immediately following gum glucose injection.
>> Out of 35 cases (16 plus 19)
>>> 23 showed a rise in B. P. averaging 24.6 mm. with a max. of 122 in one case.
>>> 11 showed a fall averaging 18.7 (maximum 72).
>>> 1 case was unchanged.
> b. Two hours after gum-glucose injection.
>> Out of 22 cases (16 plus 6)
>>> 13 had an increased B. P., average increment 16.6 mm. (maximum 38).
>>> 9 had a decrease in B. P. averaging 14.6 mm. (maximum 26).

Hence it will be seen that 66 per cent (23 out of 35) had an immediate improvement in B.P. with gum glucose but this figure could probably be equaled with saline. The important point is how was the blood pressure maintained? This can be found from the 16 complete cases. Twelve of these started with a rise (75 per cent) while 9 maintained it (66 per cent). It is interesting to find that in the larger series of 35 cases only 66 per cent showed an initial rise. Thus we may conclude that gum-glucose in shock or on the table will increase and maintain for two hours the blood pressure in 66 per cent of the cases.

However we have noted above in the nutrition case (No. 26) that glucose had little effect on normal blood pressure. The important thing is not the effect on high blood pressure which can stand a *little* fall (although $\frac{1}{3}$ of the total is bad) but what is the result where the B.P. is already critically low? It has been found clinically that when the systolic pressure falls below 85 the patient is in a serious condition. This is substantiated by Cannon's work showing that the plasma CO_2 combining power falls with B.P. as quoted previously. Eighty-five is therefore taken as a critical point. In ten cases where the B.P. was below this *all showed a rise and in all but one the rise was out of danger*. After 2 hours all but 3 were still above the danger point and 2 of these three later recovered. The one case where the B.P. had been very low (55) reacted to 110 but sank quickly and died of shock. Two other cases of low B.P. are here included since they show the effect of gum but their deaths are due to peritonitis and so they are not included in the shock mortality.

Therefore in the eight shock cases where the blood pressure was critical only one died, a mortality of $12\frac{1}{2}$ per cent in cases which by every indication should have a bad prognosis. Thus we may conclude:

(1) That gum will raise low blood pressure in a high per cent of the cases and keep it out of danger. (2) That raising the blood pressure materially affects the prognosis.

These two conclusions are the crux of the whole gum-glucose therapy. They may be tested by analyzing the mortality as shown in the whole series of 53 cases.

SYSTOLIC BLOOD PRESSURES

CASE NUMBER	PREINJECTION	POSTINJECTION	2 HRS. POST	
1.— 8	60	85	95	(+35)
2.— 11	55	110	Died	Shock
3.— 16	74	114	90	(+16)
4.— 20	84	100	78	(− 6)
5.— 22	60		70	(+10)
6.— 34	80	125	92	(+12)
7.— 35	70		98	(+18)
8.— 36	82	122	100	(+18)
9.— 13	48	110	Died ⎫	Peri-
10.— 27	84	104	Died ⎰	tonitis

Average increase — +38 mm.   +15 mm.

4. *The Effect of Gum-glucose on the Death Rate from Surgical Shock.*
—There were 12 deaths in the 53 cases, an apparent mortality of 22 per cent. However this paper deals with the results of gum-glucose administration in surgical shock while several of these deaths were due to quite different causes. Five of the so-called shock conditions were really collapse due to peritonitis and sepsis.

Case No. 12 died two days postoperative with a temperature of 106.4° and received gum only seven hours before death.

Case No. 13 died four days postoperative with a temperature of 107.6° and received gum only four hours before death.

Case No. 27 died two days postoperative with a temperature of 107° and received gum five hours before death.

Case No. 35 died five days postoperative with a temperature of 106° and received gum five days before death.

Case No. 44 died three days postoperative with a temperature of 107° and received gum four hours before death.

These five cases were moribund with peritonitis before the gum-glucose was given and therefore should not be included in any statistics on surgical shock. Gum was probably indicated in their condition but it is not being advocated as a *cure* for peritonitis.

Another case No. 32 also died of "septic shock." The patient had had a plastic operation for a rectocele and had recovered in good condition. Eight days postoperative she was taken with sudden severe pain in the left lower quadrant with a temperature of 101. A left femoral hernia was found and the diagnosis of strangulation was made. Patient was in shock, B.P. 88/60, so operation was deferred to next day, then herniotomy was attempted under novocain. Patient received gum during the operation. The sac was opened with

difficulty and found to contain only a blood clot. The abdomen was then opened and no loop of blackened gut found, but the veins of the left broad ligament were found thrombosed. Abdomen immediately closed. Patient reacted poorly, the gum kept the blood pressure up to 115/65 but the patient gradually sank and died seven days later with a terminal temperature of 105. This death can be definitely laid to sepsis.

These 6 septic cases were included in the series as it was desired to analyze every case that received gum-glucose to see if any had shown any unfavorable results. For the same reason two cases that received the glucose for nutrition were included. These cases will be omitted from the statistical study of surgical shock mortality. This leaves 45 cases that received gum either prophylactically or in the treatment of shock. Of these 45, twenty-six received gum glucose prophylactically during the operation for indications mentioned previously. Four of these went into shock, Nos. 9, 10, 28, and 49, a prophylaxis of 85 per cent, and one of these, No. 9, finally recovered making the real prophylaxis 89 per cent.

(One other case, No. 46, recovered perfectly from the operation where she received gum, but five days later developed acute intestinal obstruction and died. This death is not included as due to shock.)

Nineteen cases were in shock and received gum as treatment. Two were cases that went bad on the table and received the gum glucose there.

Sixteen received the gum glucose in the recovery room.

One received the gum glucose in the ward.

Two died, Nos. 11 and 19, a mortality of 10.5 per cent.

Combining the statistics, prophylactic and treatment, there were 45 poor-risk patients that received gum-glucose and five died of shock, a mortality of 11 per cent.

Thus G.-g. is nearly 90 per cent efficient in the treatment of surgical shock, including prophylaxis as a treatment as it is in the broader sense. This result corroborates the conclusions drawn from the gum-glucose effect on critical blood pressure where it saved seven out of eight.

Before concluding it might be worth while to consider the five shock deaths and see if possible wherein gum-glucose failed.

CASE No. 10. Here was a very poor risk. Patient aged sixty two was subjected to a severe operation lasting over two hours. She reached the recovery room in shock, in spite of 580 c.c. of gum-glucose during the operation, and died 1½ hours post operative.

CASE No. 11. The data is incomplete but patient after an operation of only one hour and eight minutes went into shock two hours postoperative. Six hundred and seventy-five c.c. of gum raised the blood pressure from 55 to 110. Three hours later

350 c.c. more gum was given. The pulse improved in quality during the injection but failed soon after and the patient died two hours later in shock, in spite of many stimulants.

CASE No. 23. This was also a very poor operative risk, a case of adherent adeno-carcinoma of colon with extensive metastases. Radical operation, patient received gum glucose both during and after the operation, 600 c.c. in all, but died in shock 7½ hours postoperative.

These three cases emphasize the fact that gum glucose is not infallible. It is not a specific but an aid to the patient's resistance; however, the patient must have some resistance. It will be noted that in the second case (No. 11) the gum did raise the pressure but the patient did not rally.

CASE No. 19. This death occurred through mistake. Case of menorrhagia, operation was deferred once and patient sent to country for anemia. On return the red count showed five million cells. Operation was performed and patient went into shock postoperative. Gum-glucose not given till two hours later and patient died in three hours. After death the red cell pipette was found to be 250 per cent inaccurate and the patient's real preoperative blood count was only two million. She should have been transfused before the operation, and failing this, the shock should have been treated with a transfusion and gum merely given till the donor was ready. Gum-glucose failed because there were not enough red cells left and also because it was given so late that it had no chance to exert any beneficial action at all.

CASE No. 49. Patient went into shock three hours after a panhysterectomy in spite of 400 c.c. of gum-glucose prophylactically. Received Harris drip during night and 15 hours postoperative received 1000 c.c. of saline and 6 per cent glucose given rapidly (no gum) intravenously. Patient died in two hours of pulmonary edema (shown by autopsy). This death was therefore directly due to the overburdening of the circulation with the sudden inflow of 1000 c.c. which was given on top of 400 c.c. of previous intravenous and the Harris drip. Further the 1000 c.c. contained no gum and as has been shown experimentally solutions of crystalloids often give edema of the tissues. This death cannot be blamed on gum-glucose but is really an argument for gum. However 1000 c.c. even with gum is too much to give at one intravenous injection.

These failures of gum only serve to show that gum-glucose has limitations as stated, the patient must have some resistance, "enough" blood left, and the gum-glucose must be given early. Gum failed also in the cases of peritonitis but this is not surprising. However, when gum is given for one of its indications it is distinctly useful, 90 per cent efficient as shown above. There is not room to quote the cases where it gave "remarkable results"; the figures must speak for that, but while on the subject the few unfavorable results should be mentioned, and explained if possible.

Unfavorable Results:

CASE No. 53. Gum-glucose was started soon after the operation was commenced, being given as a prophylactic to prevent too great a fall in a case of high blood pressure. After one hour and forty minutes of administration (about 325 c.c. given) the pulse suddenly became weak and somewhat irregular. The blood pressure fell from 152 to 106. Camphor in oil 2 gr. was given by hypo and the pulse became strong and regular and the blood pressure rose so that the patient left the table in good

condition, Pulse 116, Resp. 24, and B.P. 147 90. Patient recovered uneventfully. However the operation was cut short by the pulse actions. It is a question whether this effect was due to the gum-glucose or to the operation. At any event the pulse recovered even though the gum-glucose was continued till 190 c.c. more had been injected after the pulse failure; a total of 510 c.c. This result therefore cannot be laid to any specific "toxic" manifestation of gum-glucose.

CASE No. 31. Case of postoperative vomiting that persisted for two days. Glucose was started intravenously for nutrition. After about one hour of administration the patient had such a severe chill that the injection had to be stopped; 250 c.c. had been given in 55 minutes. The chill was so severe that there was a question of pulmonary edema (Pulse 152, Resp. 40). However patient recovered perfectly within an hour with three adrenalin injections. The emesis continued for three more days; hypodermoclysis of 3 per cent glucose maintained the nutrition. Patient recovered.

The diagnosis of pulmonary edema was never definite in this case. The house surgeon insisted that it was merely a violent chill resulting from giving the solution at too low a temperature. It is well known that this will cause an intense chill, even with saline. This is supported by the fact that this case received the gum-glucose solution in the ward with the help of a nurse inexperienced in the technic. In over 200 cases where the administration has been supervised as in the operating room and recovery room there have been no cases of edema, and chills have occurred only occasionally with definite lapses in technic. However in fairness, the possibility of pulmonary edema must be admitted and discussed.

In the first place gum was not indicated at all, the blood pressure was not low, the patient merely needed glucose for food and some fluid to prevent desiccation. Hypodermoclysis of plain glucose would have been much better. Still theoretically 250 c.c. of gum-glucose should not have caused any serious harm. The only answer is that this 250 c.c. must have overloaded a circulation that was *not depleted*. This is the danger of intravenous work (compare the case of pulmonary edema following saline mentioned above). It has been claimed that gum itself is dangerous (Kruze) but Cannon has stated in a recent communication that all deleterious results reported have occurred in cases where "powdered gum" was used. Powdered gum is not as pure as the gum "pearls." Thus there are two ways of explaining this edema, 1, that it was the result of errors in technic; and, 2, that it was one of the mechanical dangers occurring in any intravenous work. In all probability it did not occur at all but accepting the most pessimistic of the above explanations, that it is a danger accompanying intravenous work, it should be noted that the danger is quite rare with gum, only one case in over 200, and is *mild* with gum, the patient recovered perfectly within one hour. Following these indicators it will be seen that instead of being a toxic effect of gum, as some people have claimed, the edema was a purely mechanical danger which is mitigated by gum.

To summarize the harmful effects:

1. A chill following injection—this is annoying but not dangerous.

2. The remote danger of pulmonary edema.

3. The mechanical danger of overburdening a weakened heart or heart going bad under the strain. No. 53 (any intravenous work where large volumes of fluid are injected is contraindicated with a bad heart).

These mechanical dangers in their rarity are quite overbalanced by the obvious favorable results shown in this series. It has been seen that gum-glucose:

1. Increases urinary output in shock.

2. Tends to diminish postoperative vomiting.

3. Will increase and maintain for two hours at least the blood pressure in 66 per cent of the cases.

4. Raises and maintains critical blood pressure.

5. Shows a prophylaxis against shock of over 85 per cent.

6. Gives a prophylaxis against death from shock of 89 per cent.

7. Is nontoxic. (No symptoms or deaths in this series can be laid to any specific deleterious action of gum.)

In conclusion therefore we may say that as seen in this series gum-glucose, properly prepared and administered, is a safe method of combating surgical (or "secondary") shock, and if it is given prophylactically or early in the condition it is nearly 90 per cent efficient in preventing death.

SUMMARY

The essential element in shock is the fall in blood pressure with consequent decreased tissue oxygenation resulting in:

1. Production of tissue toxins.

2. Production of acidosis as shown by lowered alkali reserve.

3. Decreased renal output and probably impaired liver cell activity.

4. Final paralysis of vital nerve centers. Hemorrhage markedly aggravates the difficulties of oxygen transport and hence the state of shock.

Therapy consists of maintaining the blood pressure, (also body heat). For the former:

Saline is ineffective experimentally and clinically and is sometimes dangerous.

Gum-glucose is efficient experimentally and the clinical results shown in this series justify the following conclusions:

1. Gum-glucose is absolutely nontoxic and comparatively free from mechanical danger.

2. Maintains renal output in shock, and diminishes vomiting.

3. Raises and maintains critical blood pressure.

4. Is nearly 90 per cent efficient in combating shock.

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Following are the tabulated case reports. Owing to the lack of space many abbreviations were used, as G.-g. for gum-glucose; R.R. or Recov. Rm. for Recovery Room; B.P. for blood pressure, etc.

It will be noted that the report gives the case no., the date, where gum-glucose was given, i.e., whether in the operating room, recovery room, or after patient had returned to ward; the amount given and how long after the operation; the indication, i.e., prophylactic or shock, or as in two cases for nutrition; blood pressures are recorded wherever possible and under the headings of Pre- and Postoperative and Pre- and Postgum and also two hours after the gum injection. The diuretic effect is recorded as the number of ounces of urine excreted in the first twenty-four hours following gum while the vomiting is taken as the number of times postoperative. The time of operating (not of total anesthesia) is recorded and finally a brief discussion of the case giving the real reason for giving the gum-glucose, where this has been noted on the chart, and the result.

TABLE I

NO.	CASE NO.	DATE	WHERE GIVEN			AM'T IN C.C.	TIME AFTER OP.	REASON FOR GIVING			BLOOD PRESSURES					DIURETIC EFFECT OZ. URINE IN 24 HRS. POST-GUM	POSTOP. VOMITING NO. TIMES IN 24 HRS.	TIME OF OP. HR. MIN.	DISCUSSION
			OP. ROOM	RECOV. ROOM	WARDS			PRO-PHY-LACTIC	SHOCK	NUTRI-TION	PREOP.	POSTOP.	PRE-GUM	POST-GUM	2 HRS. POST-GUM				
1	25846	6/20	*			400 500	during 16 hr.	*			125/80					26½ 17½	1	1 hr. 20	Case of adherent pus tubes opened into during op. Gum given with addition of 300 c.c. saline. Arrived in recov. rm. in fair condition (P. 132; R. 36). Pelvic peritonitis. 500 c.c. more gum in 16 hrs. and 3 hrs. following P. 150, good quality, and R. 16. Did not go into shock. Recovered.
2	25853	6/20	*			450	during	*			175/95	130/75	120/	130/	130/	21	4	2 hr.	Gum given for fall in B.P. from 175 to 120. Raised it to 135. Pt. to recov. rm. in good cond. (P. 184; R. 24.) Recovered.
3	25862	6/20	*			300	during	*			126/75	110/60				16	3	1 hr. 10	To recov. rm. in fairly good cond. (P. 120; R. 24.) Blood CO_2 only 48 on next day. Patient recovered uneventfully.
4	25889	6/20	*			400	during	*			115/80	118/75				21	6	1 hr. 40	CO_2 before op. was 68 but gum given because op. was quite difficult. To recov. rm. in good cond. (P. 156; R. 20.) Had considerable postop. vomiting. Recovered.
5	26271	9/20	*			475	during		*		120/78	125/80				36	0	2 hr. 30	Pt. went bad during long op. but after gum arrived at recov. rm. in good cond. (P. 132; R. 30.) No vomiting. Recovered.

TABLE I—Continued

NO.	CASE NO.	DATE	WHERE GIVEN			AM'T IN C.C.	TIME AFTER OP.	REASON FOR GIVING			BLOOD PRESSURES					DIURETIC EFFECT OZ. URINE IN 24 HRS POST GUM	POSTOP. VOMIT TIMES IN 24 HRS.	TIME OF OP. HR. MIN.	DISCUSSION
			OP. ROOM	RECOV. ROOM	WARDS			PROPHYLACTIC	SHOCK	NUTRITION	PREOP.	POSTOP.	PRE-GUM	POST-GUM	2 HRS. POST GUM				
6	26326	9/20			•	300	72 hr.						130,80	143/90					Had returned to ward in good condition, but two days later showed symptoms of larger concealed hemorrhage. B.P. fell from 180 to 80, pulse rose from 70 to 120 and weak. Gum-glucose given and pulse picked up in quality and B.P. rose to 145/90. Five hrs. later a transfusion was given. Sixteen hrs. after this the pulse was 80 and pt. was in good cond. Recovered.
7	26257	12/20	•			520	during	•			120,80		120,80	115,80		14	2	2 hr. 40	Prophylactic measure in very long radical Wertheim op. for Ca. Pt. left table in good cond. and 2 hrs later P. was 82, R 20. Recovered
8	26674	12/20		•		475	1½ hr.		•		120,85	68/?	60,?	85,55	95 ?	18½	0	1 hr. 40	To recov. rm. in poor cond. (P. 144, pulse irreg. R 32.) Bleeding from vagina which was packed. B.P. went ¾ hr. after gum was started pulse improved greatly in qual. by 1124, R fell to 86. B.P. rose to 115, R 22. Recovered uneventfully
9	26682	12/20	•			400	during	•								8	0	1 hr. 40	Proph. for rad. op. for Ca. but to recov. rm. in poor cond. (P. 138, R 32.) Received gum gtts one intravenously and stimulants and recovered
10	27000	1/21	•			550	during	•								—		1 hr.	Pt. given gum in long rad. op. and came out in good cond. (P. 130, R 20.) Died in about 4 hr. and 20 min. postop.

TABLE I—Continued

NO.	CASE NO.	DATE	OP. ROOM	RECOV. ROOM	WARDS	AM'T IN C.C.	TIME AFTER OP.	PRO-PHYLACTIC	SHOCK	NUTRI-TION	PREOP.	POSTOP.	PRE-GUM	POST-GUM	2 HRS. POST-GUM	OZ. URINE IN 24 HRS. POST-GUM	POSTOP. VOMIT-ING NO. TIMES IN 24 HRS.	TIME OF OP. HR. MIN.	DISCUSSION
					WHERE GIVEN			REASON FOR GIVING			BLOOD PRESSURES					DIURETIC EFFECT			
11	27028	1/21		*		675 300	4 hr. 7 hr.		* *				55/?	110/70		14	0	1 hr. 8	Pt. reached the recov. rm. in poor cond. (P. 88; R. 24.) 2 hrs. later in shock. 675 c.c. gum raised B.P. from 55 to 110. Three hrs. later 350 c.c. more gum given. Pulse improved in quality during injection but failed soon after and pt. died 12 hrs. later in shock in spite of all other methods of stimulation.
12	27181	1/21		*		550	29 hr.		*							8	0	1 hr. 30	After op. pt. developed peritonitis and pulse became progressively weaker. Gum-glucose given next day without effect, died 7 hrs. following. sepsis (T. 107; P. 160).
13	27352	2/21		*		300 300	3 days 4 days		*				48/? 94/54	170/40 104/48		8	0	1 hr. 10	Pt. developed peritonitis and went into shock 2 days postop. Plain glucose intravenously raised B.P. 45 points temporarily but it fell within 3 hrs. Gum-glucose raised it from 48/? to 170/40 and maintained it till next day when it was 94/54. 300 c.c. more gum then given raised it to 104/48. However, Temp. was 107.6 and pt. died of the peritonitis 4 hrs. later.
14	28429	7/21		*		300	4 hr.		*							20	0	2 hr.	Pt. went into shock 3 hrs. postop. Received gum-glucose an hour later, pulse improved in quality and rate dropped to 104. (R. 28.) Recovered.

TABLE I — Continued

| NO. | CASE NO. | DATE | WHERE GIVEN | | | AM'T IN C.C. | TIME AFTER OP. | REASON FOR GIVING | | | BLOOD PRESSURES | | | | | | DIURETIC EFFECT | | FOSTER VOMIT- | TIME OF OP. HR. MIN. | DISCHARGED |
			OP. ROOM	RECOV. ROOM	WARDS			PRO- PHY- LACTIC	SHOCK	NUTRI- TION	PREOP.	POSTOP.	PRE- G/M	POST G/M	2 HRS. POST G/M		% URINE IN 24 HRS. POST G/M	NO. TIMES IN 24 HRS.			
15	28437	8 21		•		300	10 min.		•				88 30	84 42	85 65		29	1	1 hr 30	Arrived at recov. room in shock (much bleeding during op.). Received gum-glucose at once. P. improved in quality and rate fell from 140 in 140 later and 15 hrs. after that pt. was in good cond. B.P. 93/52 with P 140. Pt. recovered
16	28810	10 21				300	4 hr.		•		116 68	74/?	74 58	114 78	99 30		10	1	1 hr 30	Pt. in shock 3 hrs. (going into shock when pt. given). Gum glucose given 1 hr. and pulse picked up. Recovered
17	28898	9 22	•			250	during	•			160	160	160 110	160 105	140 85		14½	1	1 hr 30	In tests of glucose and bladder up to fat amount with much saving from liver, pt. arrived in recov. room in good cond. Recovered
18	28987	9 11				270	1½ hr.		•		130 75	74 54					16	2	1 hr 30	To recov. rm. in fair cond. they were in shock. To late. Gum glucose given in 3 hr. and pt. improved steadily. Next morning B.P. /P 90, R 22. Recovered satisfactorily
19	28959	11 21		•		155	17 hr.		•		128 60	64 52					6	1		Pt. very poor risk (in very bad cond.) from great severe anemia before being given gum glucose, worse it ½ hr. since but yet lived to ?

TABLE I—Continued

NO.	CASE NO.	DATE	WHERE GIVEN			AM'T IN C.C.	TIME AFTER OP.	REASON FOR GIVING			BLOOD PRESSURES					DIURETIC EFFECT OZ. URINE IN 24 HRS. POST-GUM	POSTOP. VOMITING NO. TIMES IN 24 HRS.	TIME OF OP. HR. MIN.	DISCUSSION
			OP. ROOM	RECOV. ROOM	WARDS			PROPHYLACTIC	SHOCK	NUTRITION	PREOP.	POSTOP.	PRE-GUM	POST-GUM	2 HRS. POST-GUM				
20	29004	9/21		*		100 300			*		125/85		84/66	100/70	78/60	3	2		Pt. went into shock postop. (fatty heart). 100 c.c. gum-glucose given but pulse still poor. After 300 c.c. more pulse improved. Fourteen hrs. later was in good cond. Recovered.
21	29021	9/21	*			250	during		*		152/86		99/62	94/64	84/64	15½	Freq.	1 hr. 30	Pulse went bad during op. but improved after gum-glucose. Not so good 4 hrs. later but after 12 hrs. pt. in good cond. Recovered.
22	29238	1/22		*		150	2 hr.		*		132/80	60/30	60/0		70/48	12	0	1 hr. 22	Pt. much depressed by morphine postop., but improved after gum. Recovered uneventfully.
23	29249	11/21	*	*		350 250	during 4 hr.	*	*							0	0	1 hr. 40	Case of adenocarc. of colon with metastases. Pulse gradually failed on table in spite of gum-glucose, although rate never rose above 120. In recov. rm. pulse was imperceptible, R. 38. 250 c.c. more gum-glucose given and resp. became deeper and pulse at carotids improved but rate was 160. Resp. was now 44. Pt. died 7½ hours later.
24	29334	11/21	*			325	during	*			138/60	112/55	138/66	112/55		18	0	1 hr. 37	In good cond. postop. in spite of difficult op. Recovered uneventfully.
25	29448	12/21		*		300	2 hr.		*		115/80	100/60	78/50		90/70	6½	1	1 hr. 17	Case of t. b. salpingitis adherent to rectum. Went into shock 2 hrs. postop. but improved with gum. Fecal fistula but recovered.

TABLE I—Continued

NO.	CASE NO.	DATE	WHERE GIVEN			AM'T IN C.C.	TIME AFTER OP.	REASON FOR GIVING			BLOOD PRESSURES					DIURETIC POST-OP EFFECT		TIME OFF OP.	DISCUSSION
			OP. ROOM	RECOV. ROOM	WARDS			PRO-PHY-LACTIC	SHOCK	NUTRITION	PREOP.	POSTOP.	PRE-GCM	POST-GCM	2 HRS. POST-GCM	OZ. URINE IN 24 HRS. POST GCM	VOMIT NO. TIMES IN 24 HRS	HR. MIN.	
26	29535	2/22			• • • •	300 300 300 250	22 hr. 30 hr. 54 hr. 66 hr.			• • •	138/90	135/72	108/84 110/78 116/80 115/80	114/80 112/72 118/80 114/80	115/78 108/60 116/80 110/80	45 39 26	even stop	1 hr. 15	Case had returned to ward in good cond. but developed persistent vomiting in spite of la ware. Gum glucose given for nutrition in tract 3 days. No food was taken during this time. On 4th day vomiting ceased Pt. recovered.
27	29600	2/22		•		100	27 hr.		•		175/85	115/68	84/60	104/64		1	0	1 hr. 18	Pt. developed persistent shock postop. Gum glucose 27 hrs. postop, but pt. died of sep...
28	29650	2/22	•	•		280	during	•			162/92	145/82	162/97	145/82		25	1	1 hr. 20	Pt. aged 48, with B.P. 170/90 in ward after week in bed. Gum glucose given to prevent too big a fall in B.P. during op. This is did (postop. B.P. 145/85) Pt. in good cond. postop. Re...
29	29683	1/22		•		400	½ hr.		•		140/75	80/42	80/42		92/58	19	1	1 hr. 40	Shock postop. Gum glucose given. After ½ hr. B.P. 92/58. T ... R. A.... Pt. re-covered.
30	29697	2/22		•		250	20 min.		•		140/90	85/55	85/55	95/65	114/65	20	2	2 hr. 15	B.P. fell from 140 to 85 and pulse poor quality postop. Gum glucose im...restored in ward in 15 hrs. good shape. P. 115 oedema and res. Reco...ered

TABLE I—Continued

NO.	CASE NO.	DATE	WHERE GIVEN			AM'T IN C.C.	TIME AFTER OP.	REASON FOR GIVING			BLOOD PRESSURES					DIURETIC EFFECT OZ. URINE IN 24 HRS. POST-GUM	POSTOP. VOMITING NO. TIMES IN 24 HRS.	TIME OF OP. HR. MIN.	DISCUSSION
			OP. ROOM	RECOV. ROOM	WARDS			PRO-PHY-LACTIC	SHOCK	NUTRI-TION	PREOP.	POSTOP.	PRE-GUM	POST-GUM	2 HRS. POST-GUM				
31	29793	2/22	*		*	250	45 hr.			*	132/94	118/80	115/84	125/84	120/90	18	con-stant	2 hr. 2	Pt. had been vomiting constantly for 2 days since op. Gum-glucose was started intraven. for nutrition but after 1 hr. of administration pt. had such a severe chill that had to stop. (250 c.c. had been given in 55 min., a little too fast. Pt. went bad, apparently had pulmonary edema. (T. 103; P. 152; R. 40.) However, recovered in 1 hour with adrenalin. Emesis continued for 3 more days but no more gum-glucose was given. (Hypodermoclysis 3 per cent glucose was then used.) Pt. recovered.
32	29795	3/22	*			250	during		*				86/60			23	0	1 hr. 51	Pt. had had a plastic op. for rectocele and had recovered in good cond. 8 days postop. she was taken with sudden severe pain in L. L. Q. A left fem. hernia was found and a diagnosis of strangulation was made. Pt. was in shock so op. was done under novocain and gum-glucose was given during. Op. was difficult. Sac contained only blood-clot. Abdomen opened showed thrombophlebitis of left broad lig. Abdomen closed. Pt. reacted poorly. B.P. remained 115/65 but pt. grad. sank, died in 7 d.

TABLE 1 Continued

NO.	CASE NO.	DATE	WHERE GIVEN			AM'T IN C.C.	TIME AFTER OP.	REASON FOR GIVING				BLOOD PRESSURES					DIURETIC EFFECT		TIME FOR OP.	DISCUSSION
			OP. ROOM	RECON. ROOM	WARDS			PRO PHY LACTIC	SHOCK	NUTRI TION	PREOP.	POSTOP.	PRE G.G.M	POST G.G.M	2 HRS. POST G.G.M	W/ URINE (SG.) NO. IN 24 HRS. POST G.G.M	NIGHT W/OUT TIMES IN 24 HRS	HR. M'S	
33	29806	3.22	•			280	during	•			160/95	170/105	165/100	170/105		24	0	1 hr 15	Proph. for severe op. To retain ?m. in good cond. P. 78, strong. R is. Pt. recovered.
34	29807	2.22		•		300	20 min.		•		144/88	90/65	80/65	128/76	92/70	14	Freq.	2 hr 30	After long up, was in poor cond. Pulse strong. Gum-glucose given rapidly and raised the B.P. Pt. recovered.
35	29808	3.22		•		225	13 hr.		•		117/84	115/75	70/45	98/70		1	2	1 hr 5	Much bleeding during op. To obtain postop. Gum-glucose 13 hrs later improved pulse for 8 hrs. Transfused 15 hrs. later. Pt. died in 5 days of uraemia.
36	29954	3.??	•			250	4 hr.	•			132/70	88/70	82/59	127/80	100/70	160	1	2 hr 15	Blood pressure to a satisfactory level after long up. ?um brought it to normal. To ward to guard. Recovered.
37	29922	3.??	•			180	during	•			126/?	125/?	116/?	135/?		23	0	1 hr 2	B.P. started to fall. Gum-glucose raised it above preop. level and pt. arrived to preop. in good cond.
38	29944	4.??	•			300	1 hr		•		150/80	88/60	88/60	98/65	102/70	22	1	2 hr 35	B.P. low after long op. Gum-glucose given where it reached preop. ?m raised it and pt. is good cond. within 1 hr. Re covered.
39	29762	4.??	•			600	during	•			136/82	114/72	134/74	114/62		30	0	2 hr 50	Proph. in long op. maintained B.P. and pt. to recover ?m in good cond. (P. ?8, R 34.) Recovered.

TABLE I—Continued

NO.	CASE NO.	DATE	WHERE GIVEN			AM'T IN C.C.	TIME AFTER OP.	REASON FOR GIVING			BLOOD PRESSURES					DIURETIC EFFECT OZ. URINE IN 24 HRS. POST-GUM	POSTOP. VOMITING NO. TIMES IN 24 HRS.	TIME OF OP. HR. MIN.	DISCUSSION
			OP. ROOM	RECOV. ROOM	WARDS			PRO-PHYLACTIC	SHOCK	NUTRITION	PREOP.	POSTOP.	PRE-GUM	POST-GUM	2 HRS. POST-GUM				
40	29976	4/22	*			250	during	*			115/75	108/80	115/75	108/80		32	1	1 hr. 55	Proph. in long op. B.P. fell only 7 points. To recov. rm. in good cond. (P. 84; R. 18.) Recovered.
41	29951	9/21		*		300	2½ hr.		*		136/68	104/68	100/64	108/68	96/60	12	3	3 hr. 12	Very long op., went into shock following. Had some bleeding. Pulse improved with gum-glucose. Returned to ward next morning in good cond. Recovered.
42	29994	3/22	*			150	during	*			132/75	128/70	114/72	128/70		23	3	45	Proph. in ruptured ectopic with hemorrhage. P. only rose to 100 by end of op. Returned to ward in good cond. in 2 hrs. (P. 100; R. 22.) Recovered.
43	30009	3/22	*			200.	during	*			158/95	112/	140/	160/	120/70	17	3	1 hr. 15	Proph. in pt. 68 years old. Pulse maintained good quality and to ward in good cond. (P. 108; R. 24.) Recovered.
44	30018	3/22		*		250	48 hr.		*		185/105	115/85	130/85		129/84	0	0	1 hr. 30	Pt. moribund from peritonitis when gum-glucose given. (27 hrs. postop.) Died 5 hrs. later of sepsis. T. 107.
45	30049	4/22	*			412	during	*			140/85	126/70	140/80	126/70		35	9	2 hr. 25	Proph. in long op. in pt. having had severe menorrhagia. To recov. rm. in good cond. (P. 80; R. 280.) Recovered.
46	30127	4/22	*			350	during	*			148/104	126/70	126/70	130/72		33	3	1 hr. 45	Returned to ward in good cond. Uneventful course until 5 days postop., then had persistent vomiting which became fecal and pt. died of intestinal obstruction. (mesenteric thrombosis) 5½ days postop.

TABLE I—CONTINUED

NO.	CASE NO.	DATE	OP. ROOM	RECOV. ROOM	WARDS	AM'T IN C.C.	TIME AFTER OP.	PRO-PHY-LACTIC	SHOCK	NUTRITION	PREOP.	POSTOP.	PRE-GUM	POST-GUM	2 HRS. POST-GUM	OZ. URINE IN 24 HRS. POST-GUM	POSTOP VOMIT INC NO. TIMES IN 24 HRS	TIME for 16?	DESCRIPTION
47	29961	3/22	•			125	during	•			155/94	118/74	130/75	118/74	138/70	17	1	42	Proph. in very large ...
48	29913	3/22	•			400	during	•			155/85	125/70	155/85	125/70		40	2	1 hr 11	...
49	29992	3/22	•			400	during	•			148/90	76/55	148/90	76/55		4	1	2 hr	...
50	30042	4/23	•			208	during	•			130/80	110/70	130/80	110/70		18	7	1 hr 25	...
51	30046	4/23	•			200	during	•			125/65	145/70	125/65	145/70		18	6	1 hr 22	...
52	30113	4/23	•			238	during	•			150/100	154/98	150/100	154/98		16	3	1 hr	...
53	30131	4/22	•			510	during	•			164/110	147/00	153/92	153/88	154/98	27	4	2 hr 10	...
Grand total			29					26	26	2 Cases									

A STUDY OF POSTOPERATIVE URINE ELIMINATION

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SCOPE OF INVESTIGATION

THIS study was undertaken with a threefold aim: 1. To determine the amount of urine eliminated by a patient during the first forty-eight hours after a laparotomy operation, when no special measures are used to influence this elimination. 2. To test the efficacy of various measures, used during the first forty-eight hours postoperatively, in increasing urine elimination. 3. To discover, if possible, some of the factors that lead to a decreased urine output during this period.

IMPORTANCE OF THIS SUBJECT

Although it is not the purpose of this study to prove that it is highly desirable not to allow the postoperative urine output to fall too low, it seems to me that it would not be difficult to maintain such a proposition. The functions of the urine are too well known to bear repetition. Important in health, it must be still more important in the presence of pathology anywhere in the body.

If, then, any investigation should establish the efficacy of any measure or measures in hastening the return of a normal function to a normal level after an operation, the labor of such an investigation can hardly be considered otherwise than well spent.

LITERATURE

A diligent search of the literature for the past twenty-five years failed to reveal any work of sufficient similarity to allow of comparison or contrast. What this study lost in the absence of such a guide, I trust it gained in unbiased consideration.

The number of references dealing with other features of urine secretion and elimination, more or less related to our subject, is legion. Most of the points made are now matters of common knowledge. Some of those not as generally known, perhaps, will be pointed out in their appropriate places.

In the main, the study is a record of facts as I found them, with no attempt to square the findings with anything in the literature or with the opinions of any individual.

METHOD

Just a word as to the method of approach: All the data for this problem were gathered from the records of cases operated upon and

discharged from the Woman's Hospital in the State of New York.

A six month period (October, 1921, to March, 1922) was selected purely because of the greater availability of the records for that interval. All cases were analyzed carefully in the order in which they were filed. All had to meet but one condition in order to receive consideration; that is, the patient must have had a laparotomy performed.

As might be expected, many of the cases met with had had plastic operations performed—such cases were not considered, unless they had also had a laparotomy done.

The limitation of this study to laparotomy operations is in recognition of the well-known fact that such operations are attended by a greater disturbance, as a rule, than that caused by operations that do not open into the peritoneal cavity. It is conceivable, though not proven, that this might make a difference in urine elimination and make these cases incomparable.

The features looked for in the analysis of each case will be mentioned later.

Although the number of cases found in the six months' period mentioned was sufficient for the establishment of a "normal" postoperative output, the charts of cases discharged for some two or three years back had to be consulted to locate a sufficient number of cases that had received some one of the special measures that we were investigating.

In all, certainly over 1,000 charts were thumbed and examined before the adequate number of cases necessary for this investigation were located.

Exactly 316 cases, falling in one or another of our groups, were minutely studied and are included in this report.

I. ESTABLISHING A NORMAL

As stated above, our first concern was to determine the postoperative urine output of a "normal" patient when no measures looking to the increase of such output were used.

From the point of view of our problem a "normal patient" was one who met the following requirements:

A. *Preoperative.*—No case was included which in its preoperative record showed anything that is known to influence urine elimination. Thus a *history* of chronic cardiac or renal condition, diabetes, etc.; a *physical* examination that showed evidence of any such condition; or *laboratory findings* which pointed to such involvement were criteria by which cases were excluded from consideration.

B. *Operation Proper.*—Aside from the fact that the operation must have been a laparotomy, numerous facts were noted. Thus, the length

of anesthesia, the nature of the operation, and the fall in blood pressure during the operation were all recorded.

In view of the fact that I, subsequently, failed to make out a case against any of these factors, except the change in blood pressure, as influencing urine output, no case was excluded for any reason pertaining to the operation except for (1) a fall in blood pressure of over 30 mms. Hg and (2) the use of the "hot water bottle" during operation.

C. *Postoperative.*—The chief grounds on which cases were excluded, at this stage, from the "normal" group were: (1) the use of measures other than those "postoperative orders" call for, that are known to influence urine elimination, and (2) excessive vomiting.

It may be stated here that the "Standardized Orders of the Woman's Hospital" state that "nothing is to be given by mouth for 24 hours after operation but sips of hot water." Any case that received much more than that was excluded.

Now, one of the measures, the influence of which on urine elimination was to be tested, is the "internal hot water bottle" (1½ quarts of normal saline at a temperature of 105° F. given into the rectum immediately after an operation). This procedure is known to have a stimulating effect upon the patient, improvement in respiration often being demonstrable before the patient leaves the operating table (Dr. Ward). Since the results of the use of this measure were to be compared with the established "normal" it is obvious that no case that received this could be included among the normals. Hence, no case of the 142 listed normals (Table I) belongs to the "first division" of the Woman's Hospital where this measure is used as routine for laparotomy cases.

RESULTS ("NORMAL")

Table I shows the details of the 142 cases collected in the six-month period mentioned that satisfied the "normal" requirements. (It must be stated here that although the number of factors considered before a case was considered "normal" were numerous, the actual number of cases excluded for these reasons were few—not more than 5 per cent of the cases examined.)

It is to be noted that (1) *the average urine output for the first 24 hours is 15 ounces.* (2) *The average urine output for the second 24 hours is 24 ounces.* (3) The output during the second day, when there is great variation in the intake of fluid, is extremely variable (minimum 9 ounces, maximum 42 ounces) and bears no definite relation to the first day elimination.

The output during the first 24 hours, on the other hand, is extremely

TABLE I
Normal Output

CASE NO.	RECORD NO.	DIV. NO.	OUTPUT IN 1ST 24 HRS.	OUTPUT IN 2ND 24 HRS.	% INCREASE	CASE NO.	RECORD NO.	DIV. NO.	OUTPUT IN 1ST 24 HRS.	OUTPUT IN 2ND 24 HRS.	% INCREASE
1	28921	4	18	19	6	58	29337	4	14	30	113
2	28937	4	14	12	-14	59	29327	4	16	18	13
3	28962	4	19	34	79	60	29314	3	13½	21	56
4	28966	4	13	18	38	61	29092	4	12	22½	88
5	28090	4	13	19	46	62	28961	3	12	26	117
6	28996	3	13	25	92	63	29588	3	14	23	64
7	28999	4	11	20	82	64	29607	4	12½	29	132
8	29033	4	13	30	131	65	29625	2	8	28	250
9	29049	4	13	17	31	66	29631	4	17	35	106
10	30062	4	7	18	157	67	29061	3	10	18	80
11	29080	4	23	23½	2	68	29069	2	14	20	43
12	29084	3	11	18	63	69	29127	2	17	25	47
13	29105	2	16	28	75	70	29142	2	22	40	82
14	29111	3	14	24	71	71	29267	3	11½	26	126
15	29132	4	10	17	70	72	29172	4	11½	28	155
16	28926	4	11	27	145	73	29173	4	21	40	90
17	28929	2	15	18	20	74	28189	2	12	17	41
18	28973	3	16	26	63	75	29214	4	11	31	182
19	29000	4	12	12	0	76	29237	2	15	24	60
20	29015	3	15	23	53	77	29072	3	19	16	-16
21	29032	4	10	16	60	78	29152	?	16	17	6
22	29038	3	17	25	47	79	29215	3	12	34	183
23	29054	4	13	24	85	80	29236	3	13½	16	19
24	29088	3	20	23	15	81	29239	4	15	26	73
25	29058	2	15	22	47	82	29245	4	16	11	-31
26	29059	3	12	33	92	83	29265	4	15	16	7
27	29060	4	12	22	83	84	29289	4	13½	19	41
28	29066	3	13	32	146	85	29306	4	12	27	125
29	29069	3	10	19	90	86	29636	2	18	27	50
30	29100	4	11	20	82	87	29647	2	17	11½	32
31	29106	2	12	21	75	88	29651	3	15½	23	48
32	29126	3	12	35	192	89	29668	2	15	34	127
33	29013	4	12	20	67	90	29686	2	16	24	50
34	29055	3	12	23	92	91	29690	3	16	18	13
35	29186	4	20	25	25	92	29707	2	14	22	57
36	29219	2	19	18	-5	93	29708	3	23	19	-17
37	29244	2	21½	30	40	94	29706	4	17	28½	68
38	29269	4	18½	42	127	95	29734	4	11	29	164
39	29282	3	11	38	245	96	29740	4	10	25	150
40	29293	2	16	20	25	97	29744	2	21	31	48
41	29324	2	16	23	38	98	29747	2	17	28	65
42	29332	4	19	25	31	99	29755	3	21	28	33
43	29338	3	18	37	106	100	29791	4	17	32½	88
44	29354	3	16½	27	66	101	29802	4	18	29	61
45	29358	4	15½	24	55	102	29799	4	16	23	44
46	29369	4	18	19	6	103	29680	3	11	22	100
47	29381	4	13	22	69	104	29721	4	18	32	78
48	29398	4	19	33	74	105	29227	4	16	16	0
49	29409	3	13	20	54	106	29422	4	15	21	40
50	29412	4	10	12	20	107	29437	4	13	22	69
51	29420	2	16½	26½	61	108	29476	2	15	9	-40
52	29432	2	15	28	87	109	29482	3	14	13	-7
53	29452	2	8	33	313	110	29487	4	16	23	44
54	29441	4	18	22	22	111	29489	2	17	13	-24
55	29436	4	13	25	92	112	29501	2	17	21	24
56	29415	4	16	9	-38	113	29507	4	17	21	24
57	29367	4	12½	27	116	114	29511	2	18	26	44

TABLE I—CONTINUED

CASE NO.	REC-ORD NO.	DIV. NO.	OUT-PUT IN 1ST 24 HRS.	OUT-PUT IN 2ND 24 HRS.	% IN-CREASE	CASE NO.	REC-ORD NO.	DIV. NO.	OUT-PUT IN 1ST 24 HRS.	OUT-PUT IN 2ND 24 HRS.	% IN-CREASE
115	29517	2	23	24	3	129	29528	4	20½	26	27
116	29518	4	15	33	120	130	29560	4	15	27	80
117	29519	4	13	26	100	131	29561	3	16	20	25
118	29530	3	12	35	191	132	29628	4	14	24	71
119	29551	3	12½	22½	73	133	29925	4	15	26	73
120	29556	2	18	25	39	134	29861	4	18	22	22
121	29557	3	18	28½	60	135	29896	4	17	19	12
122	29580	4	19	30	58	136	29905	4	14	18	29
123	29587	2	12	22	83	137	29989	?	16	20	25
124	29599	4	17	28	65	138	30013	4	16	35	119
125	26609	3	14	30	114	139	30023	4	15	28	87
126	29615	2	18½	22	19	140	30036	?	14	36	157
127	29302	3	18	19	6	141	29426	4	19	27	42
128	29486	?	21	21	0	142	29594	2	20	30	50
						Average			15.1	24.2	65.7

constant. The average of any 25 successive cases is very close to the average of the entire 142.

COMMENT

The "average normal" of 15 and 24 ounces for the first and second days respectively thus established, represents the urine output of the normal case operated upon in the second, third and fourth divisions of Woman's Hospital, where no special measures are used to increase the output during the first 24 hours postoperatively, and very variable measures ("water ad lib," coffee, tea, etc.) during the second day.

URINE OUTPUT IN "FIRST DIVISION" CASES

As was stated before, the "internal hot water bottle" is used as routine in the first division, immediately after the operation. Now, on this division, also, the Murphy Drip is used practically as routine.

Hence, before attempting to determine to what extent, if at all, either of these measures affects urine elimination, I thought it best to establish whether or not the combined effect of the two was sufficient to show an obvious increase in elimination. That, then, was the next step in this study.

II. EFFICACY OF VARIOUS MEASURES

A. *"Hot Water Bottle" and Murphy Drip.*—The cases included in this group are exactly similar to the normals, except for the use of the hot water bottle at the operation and the Murphy drip during the two days following. Any change in the urine output can, therefore, be justly ascribed to these measures.

Table II shows the 44 cases of the first division collected to test the value of these measures.

It will be seen: (1) That the average output during the first 24 hours is 21 ounces, or 40 per cent greater than the "average normal." (2) That the average output during the second 24 hours is 25 ounces, which is only one ounce more than that of the "average normal" for the same period. (3) That whereas the outputs for the first day run about the same throughout, those for the second day show marked variations and bear no definite relations to those of the

TABLE II

MURPHY DRIP "HOT WATER BOTTLE"

CASE NO.	REC-ORD NO.	DIV. NO.	OUT PUT IN 1ST 24 HRS.	OUT PUT IN 2ND 24 HRS.	% IN CREASE	CASE NO.	REC ORD NO.	DIV. NO.	OUT PUT IN 1ST 24 HRS.	OUT PUT IN 2ND 24 HRS.	% IN CREASE
1	29001	1	16	17	6	23	29125	1	21	19	– 9
2	29078	1	15	29	94	24	29129	1	25	25	6
3	29083	1	20	32	60	25	29264	1	20	12	–40
4	29114	1	16	21	31	26	29290	1	31	30	– 3
5	28936	1	54	35*	–35	27	29666	1	18	14*	–22
6	28943	1	23	30	30	28	29698	1	26½	32	21
7	28972	1	14	16	14	29	29705	1	13	25	92
8	28987	1	13	25	92	30	29724	1	13	22	69
9	29028	1	21	25	19	31	29742	1	21	33	57
10	29047	1	15	15	0	32	29785	1	17	20	18
11	29108	1	20	17	–15	33	29792	1	20	28	40
12	29128	1	17	21	24	34	29434	1	24	33*	38
13	29318	1	18½	28	51	35	29689	1	20	23*	15
14	29384	1	17	28	65	36	29483	1	19	34*	79
15	29389	1	25½	26	2	37	29493	1	22	40½*	84
16	29439	1	13	23	77	38	29537	1	28	35*	25
17	29571	1	17	26	53	39	29866	1	26½	26*	– 2
18	29582	1	19	24*	26	40	29935	1	26	32	23
19	29010	1	11	20	82	41	29782	1	43½	33	–24
20	29154	1	17	17	0	42	29848	1	21	18	–14
21	29250	1	28	37	32	43	29902	1	16	16	0
22	29268	1	19	27	42	44	29948	1	27	43	59
						Average			21.1	24.8	29.9

*Murphy drip given 1st day only.

first day. (4) That the average percentage increase is 30 over the first day, as compared with a 66 per cent increase of the second day over the first, in the normal cases.

COMMENT

Thus far we know that those cases that received both the "internal hot water bottle" and the Murphy drip put out 40 per cent more urine during the first day than those that received neither of these agents. We may now ask what part does each play in producing this increase?

To answer this question, it is obvious that we must study cases where one was used without the other.

To be entirely fair let us see what the Murphy drip alone can do to urine elimination when it is used on other divisions than the first.

B. *Murphy Drip Alone.*—Table III shows the effect of the Murphy drip used on otherwise "normal" postoperative cases. We see that: (1) The average output of 26 cases that received the Murphy drip only, is 19 ounces, or 27 per cent more than the "average normal" output for the first 24 hours. (2) The average output for the second day is exactly the same with the Murphy drip as it was without it (24 ounces). (3) The variability of the second day's elimination and its irregular relations to the first day's elimination (– 29 per cent plus 169 per cent) is again evident.

<div align="center">

TABLE III

MURPHY DRIP ALONE

</div>

CASE NO.	REC- ORD NO.	DIV. NO.	OUT- PUT IN 1ST 24 HRS.	OUT- PUT IN 2ND 24 HRS.	% IN- CREASE	CASE NO.	REC- ORD NO.	DIV. NO.	OUT- PUT IN 1ST 24 HRS.	OUT- PUT IN 2ND 24 HRS.	% IN- CREASE
1	28958	4	11	23	109	14	29051	3	17½	26	49
2	28941	4	15	19	27	15	29137	2	13½	26	93
3	28952	2	18	19	6	16	29145	4	11*	27	145
4	28971	4	15	14	– 7	17	29157	2	21½	23	7
5	28974	4	13	20	54	18	29156	3	14	20	43
6	28981	4	13	35	169	19	29275	3	30	18½	–38
7	28984	2	24	"q. s."	–	20	29277	4	20	19	– 5
8	28985	4	28	31	11	21	29638	3	17	17½	3
9	29016	4	22	30	32	22	29581	4	17½	22†	31
10	29462	4	16½	19	15	23	29654	4	33	32	– 3
11	29435	3	16	16½	3	24	29730	4	21	30	43
12	29258	2	10½*	38	262	25	29936	2	28	20†	–29
13	29409	3	20	16	–20	26	30011	3	18	35	94
						Average			19.2	24.0	27.3

*=Murphy Drip 2nd day only.
†=Murphy Drip 1st day only.

<div align="center">

COMMENT

</div>

The Murphy drip as given at the Woman's Hospital consists of a solution of 5 per cent glucose and 2 per cent bicarbonate of soda administered rectally at a regulated rate (about 30 drops per minute), and moderate pressure, the container being held about one foot above the bed. Provision is made for the escape of gas.

Now Murphy* originally pointed out that the "retention of fluid in the colon depends entirely on its method of administration"— his method being designed to give optimum conditions for such retention.

That it does so, is shown by the fact that in 65 cases in which it

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*Murphy, J. B.: Jour. Am. Med. Assn., April 17, 1909, lii, 1248.

was used, in only 6, or less than 10 per cent, did I find the nurse's note "not well absorbed." The cases used above were only those which had complete absorption.

It is interesting to note that in all divisions, other than the first, of the Woman's Hospital, the so-called Harris drip is often used instead of the Murphy drip. The comparative efficiency of this measure (which differs from the Murphy chiefly in that the container is not raised above the level of the bed, no provision is made for the escape of gas, and the rate of flow not so accurately regulated) was tested. The findings may be briefly summarized as follows:

MEASURE USED	NUMBER OF CASES	NUMBER WITH COMPLETE ABSORPTION	PER CENT COMPLETE ABSORPTION	OUTPUT IN FIRST 24 HOURS OF CASE WITH COMPLETE ABSORPTION
Murphy drip	65	59	91	19 oz.
Harris drip	38	24	63	18½ oz.

In other words, the Harris drip is quite as efficient in increasing the urine output as is the Murphy drip, but the latter is much better absorbed. Obviously, in either case, the effect on urine elimination must vary directly with absorption.

Having shown that the combined use of the "hot water bottle" and Murphy drip causes an increase of 40 per cent above normal, and that the Murphy drip alone will explain approximately 25 per cent of this rise, we may infer that the hot water bottle alone helps to the extent of 15 per cent.

Let us see whether this influence is correct.

C. *Hot Water Bottle Alone.*—Table IV represents a group of cases in which the only influence, other than normal, exerted upon urine secretion was the use of the "internal hot water bottle" at the time of operation.

TABLE IV

HOT WATER BOTTLE ONLY

CASE NO.	RECORD NO.	DIV. NO.	OUTPUT IN 1ST 24 HRS.	OUTPUT IN 2ND 24 HRS.	% INCREASE	CASE NO.	RECORD NO.	DIV. NO.	OUTPUT IN 1ST 24 HRS.	OUTPUT IN 2ND 24 HRS.	% INCREASE
1	29027	1	32	22	−31	12	29203	1	19	23	21
2	29042	1	24	19	−21	13	29225	1	28	27	− 4
3	29213	1	17	22	29	14	29067	1	20	35	75
4	29296	1	12	13	8	15	29175	1	18	20	11
5	29045	1	17	23	35	16	29224	1	15	21	40
6	29121	1	16	14	−12	17	29248	1	18	17	−56
7	29144	1	21	23	10	18	29762	1	22	16	−27
8	29149	1	14	24	71	19	29726	1	15	19	27
9	29162	1	14	26	86	20	29627	1	12½	25	100
10	29163	1	21	15	−28	21	29342	1	20	22	10
11	29178	1	12	20	67	Average			18.4	21.2	19.6

In the main it shows that: (1) *With the "hot water bottle" the out-put for the first 24 hours is about 18½ ounces, or 23 per cent above normal.* (2) The output for the second day is 21 ounces or 3 ounces less than the average normal output for the same period.

<center>COMMENT</center>

We see that instead of the expected 15 per cent increase, we ac-tually find a 23 per cent gain. That is, although, separately, we find a 27 per cent and 23 per cent increase for the Murphy drip and hot water bottle respectively, when used together, they give a 40 per cent increase, instead of the theoretical 50 per cent.

The comparatively low output during the second day is readily explained by the fact that on the first division, the Murphy drip is ordinarily used on the first two postoperative days, a measure which these cases did not receive. In other words, the number of urinary stimulants received by these patients during the second day was less than those received by the "normal" cases. (This subject will be commented upon again below.)

D. *Gum Glucose.*—At the outset it must be said that gum glucose (6 per cent gum acacia plus 20 per cent glucose) is used at the Woman's Hospital practically as a routine measure during an opera-tion, in those cases in which the blood pressure falls 30 mm. Hg. or more. That is, it is used in cases of shock or impending surgical shock. Occasionally it is used as a prophylactic measure before the blood pressure actually begins to fall, in such cases where a marked fall is anticipated or where the patient prior to operation has a moderately low blood pressure and could not stand even a moderate reduction.

From our point of view, the point to be stressed is that the great majority of patients who received gum glucose had had a fall in systolic blood pressure of at least 30 mm. Hg. Hence, before I could compare the urine output of these cases with those that had received other or no special measures, it was necessary to determine the in-fluence of a fall of 30 mm. Hg. in systolic blood pressure upon urine elimination. That is, I had to establish a normal for this type of case with which I could justly compare the results obtained from gum glucose administration.

Here, we must anticipate somewhat, and state that such a study was made (see Table VI) and that the average urine output for those cases that had a fall of 30 points in blood pressure during operation but which did not get gum glucose, was: first day (a) 12½ oz. (uncorrected for other measures), (b) 11 oz. (corrected for other measures); second day, 23½ oz.

We are now prepared to examine cases in which gum glucose was

administered, and are in a position to judge accurately of its value
as a stimulant to urine elimination.

Table V shows the details of this phase of the investigation. You
will note that the actual urine output is recorded in one column and
in the next column is recorded the "corrected output," that is, the
output after 23 per cent, 27 per cent, and 40 per cent, had been de-
ducted from the cases that had received the "hot water bottle" alone,
the Murphy drip alone, or both, respectively. This is in accordance
with the influence of these respective measures in increasing urine
output as has been previously definitely established. (See Tables
II, III and IV.) The average of these corrected figures, therefore,

TABLE V

EFFECT OF GUM GLUCOSE

CASE NO.	RECORD NUMBER	AMOUNT OF GUM GLUCOSE	"HOT WATER BOTTLE"	FLUID BY "DRIP"	ACTUAL OUTPUT IN 1ST 24 HRS.	CORRECTED OUTPUT	ACTUAL OUTPUT IN 2ND 24 HRS.
1	25846	700 c.c.	0	+	$26\frac{1}{2}$	$19\frac{1}{2}$	16
2	25853	450 "	0	0	21	21	$22\frac{1}{2}$
3	25862	300 "	0	0	16	16	23
4	25889	400 "	0	—	21	15	24
5	26271	475 "	0	—	36	26	20
6	26674	475 "	0	—	$18\frac{1}{2}$	$13\frac{1}{2}$	26
7	26757	520 "	0	+	14	10	21
8	26782	400 "	0	0	13	13	30
9	28437	300 "	0	.	18	13	20
10	28429	300 "	0	0	$12\frac{1}{2}$	$12\frac{1}{2}$	20
11	28982	270 "	0	—	16	12	35
12	29021	250 "	0	0	$15\frac{1}{2}$	$15\frac{1}{2}$	20
13	29238	150 "	+	—	12	7	14
14	29334	325 "	+	—	19	11	30
15	29535	300 "	+	.	24	14	28
16	29659	280 "	+	—	$22\frac{1}{2}$	$13\frac{1}{2}$	30
17	29697	250 "	0	—	20	15	25
18	29795	250 "	0	0	23	23	16
19	29806	280 "	—	—	28	17	21
20	29807	300 "	0	+	21	16	$12\frac{1}{2}$
21	29898	250 "	0	—	$14\frac{1}{2}$	11	15
22	29913	400 "	0	—	36	26	30
23	29922	180 "	—	0	23	18	31
24	29944	300 "	0	—	22	16	29
25	29951	300 "	0	+	12	9	34
26	29954	250 "	0	—	$15\frac{1}{2}$	12	26
27	29961	120 "	0	—	17	13	18
28	29962	600 "	—	—	$29\frac{1}{2}$	12	26
29	29976	250 "	—	—	32	19	19
30	29994	150 "	0	0	28	28	13
31	30009	200 "	0	—	17	13	28
32	30046	200 "	—	—	24	17	40
33	30042	208 "	0	—	22	18	27
34	30049	412 "	—	—	35	21	25
35	30127	350 "	0	—	34	24	20
36	30143	238 "	—	—	16	10	26
37	30232	250 "	—	—	16	10	30
				Average	18.4	15.6	24.1

represents accurately the output of cases with fallen blood pressures to whom gum glucose was administered.

The results as shown in Table V are: (1) The average elimination of patients who had received gum glucose after a fall in blood pressure of over 30 mm. of Hg. is 15½ ounces, for the first 24 hours after operation. (2) The average output for the second day is 24½ ounces, that is approximately the same as the output of normal cases (24 ounces). (3) The first day's output of 15½ ounces is 40 per cent higher than the first day's output of similar cases with similar falls in blood pressure, but who did not receive gum glucose. (4) The 40 per cent increase brought about by gum glucose is just sufficient to raise the urine output to the level of the "normal case"—that is, the case that had no fall in pressure of any moment and which received no special measures for increasing urine output. (5) The amount of gum glucose administered does not bear any definite relation to the urine put out. The small amounts seem to be just as effective as the large ones.

E. *Other Measures.*—We have now studied in detail the effect of the more commonly used measures, upon urine output. Occasionally other measures and procedures are used the influence of which on urine elimination I should have very much liked to determine with the same detail and accuracy as those reported above. Among these, might be mentioned transfusions, hypodermoclysis, etc. It is only fair to state, however, that it required well nigh desperate efforts to collect the data presented in this paper in the time allotted for this investigation, to say nothing about gathering sufficient cases of rarer types to allow of the same analytical treatment and permit of definite conclusions.

The number of cases we succeeded in gathering, where these less common measures were used, I find, is not nearly sufficient to allow of definite statements concerning them and any consideration of them will for that reason be omitted.

It will be recalled that although the average output during the first postoperative day varied much with the various measures used (15 to 21 ounces) the output of the second day remained remarkably constant, in the aggregate, there being no more than one ounce difference between the averages of the various groups of cases. No one measure seemed to be able to influence it.

Viewed from a different angle, we may ask why it is that, although, as previously shown, the average output on the first day of cases that received the Murphy drip and "hot water bottle" was 40 per cent higher than those who received neither of these, the output on the second day was essentially the same in both.

Briefly stated, the answer doubtless lies in the fact that during

the second day the eliminative powers of the patients are stimulated to a maximum by a variety of measures, and the maximum output of patients at this time is essentially the same—when large groups are considered.

Hospital regulations call for no particular restrictions as to fluid intake during the second day. Unlike the first postoperative day, then, quantitative studies, when so many variable and uncontrollable factors are introduced, are quite unprofitable.

Among the various measures used during the second day to stimulate urine elimination (besides those already discussed), or those used for other purposes, but which are known to influence urine secretion, may be mentioned: (1)* Water: There being no contraindication in most cases to water by mouth during the second day, we find often in the "nurse's notes" for this day "water ad lib" and the majority of such cases reflected this fact very obviously in their urine output for that day. (2) Digitalis: That any agent which will improve the general circulation will by the same token act as a diuretic is a well accepted principle. Digitalis (digalen or digifoline) is, of course, the king of cardiac stimulants.

Many cases that just would not put out a normal amount of urine during the first day, in spite of any and all measures, would more than surpass the normal on the next day after just a few doses of digalen. Witness the case (Record No. 29412) where 12 ounces were put out the first day in spite of a hot water bottle and Murphy drip, and 30 ounces the second day after digifoline. Or, still more marked, a case (Record No. 29452) in which eight ounces were voided the first day as against 33 ounces the second day following 90 m. of digalen (6 doses).

In these cases, evidently, cardiac action was not normal,—the poor general circulation leading to a low urine elimination. Were this not the explanation, digitalis would not have influenced the urine elimination Sollman states.† Numerous cases were encountered that illustrated this same point. (3)‡ Caffein: Hot tea and coffee are mentioned in the "nurse's notes" of practically every case, during the second postoperative day. Now, we need hardly stop to point out that the caffein thus administered is bound to increase urine elimination. Nor shall we enter upon the discussion as to whether this action is due entirely to renal stimulation or whether it is also due in part to its action upon the heart and its peripheral dilatation of renal arterioles.

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*Raphael "Diuresis," Dorpat. Arb., 10, 81, 1864.
(Raphael showed that in normal people 1000 c.c. H₂O causes an increase of urine output of 100 per cent.)
†Sollman: A Manual of Pharmacology, p. 390.
‡5 gm. caffein causes an increase in urine output of 42 per cent according to Raphael.

For our purpose, suffice it to say that the caffein given practically all patients during the second day explains, in no small measure, the greater output during the second day as compared with the first day.

Water ad lib, tea, and coffee (caffein), digitalis (in cases of poor cardiac action) in addition to the Murphy or Harris drip, explain why the urine output during the second day was always higher than the first (66 per cent higher in our normal cases). These measures used to the full extent of the requirements of each case, explain further why it is that the average output of any group of cases, whatever their output during the first day, was always high and quite constant. Each case was stimulated to its utmost by one, several, or all of these measures, and the utmost is a constant quantity when any *group* of cases in approximately the same condition (all in the second day, after a laparotomy operation) is considered.

We leave here the consideration of the factors that increase urine output. We shall now turn to the third and last part of our quest, that is, to attempt to discover any factor or factors that lead to a low postoperative urine elimination.

Cases with preoperative conditions that are attended by poor elimination of urine are, as stated at the outset, excluded from this study.

III. FACTORS IN LOW URINE OUTPUT

One is reluctant to omit a detailed statement of that part of his study, which, though unproductive of positive results, consumed much of his time. It will be sufficient to state that every factor that might conceivably have led to a diminished urine output was investigated. Thus, all the cases studied were grouped according to age, nature of operation, length of operation and anesthesia, etc., all with negative results. That is, all else being equal, the figures did not show that an aged patient puts out less urine than a younger one; that a patient who had had an extensive plastic and abdominal operation puts out less than one who merely had an appendectomy; nor that the length of anesthesia makes any difference in urine elimination.

But one factor was found that, consistently, was accompanied by a low urine output. That is (a) a marked fall in blood pressure. It will be remembered that the influence of a fall in blood pressure of over 30 mm. of Hg. (during the operation) on urine output, had to be determined first, before the effect of gum glucose could be properly evaluated.

Table VI is a record of 46 cases that had a fall in blood pressure of over 30 points during the operation.

You will see that (1) even if no allowance is made for the influence of the Murphy drip and hot water bottle that some of these patients received during the first postoperative day, their average output

TABLE VI

EFFECT OF MARKED FALL IN BLOOD PRESSURE [< 40MM. HG.]

CASE NO.	REC-ORD NO.	DIV. NO.	FALL IN SYSTOLIC BLOOD PRESSURE	SYSTOLIC BLOOD PRESSURE AFTER FALL	HOT WATER BOTTLE	M'P'E PHY DRIP	OUT PUT IN 1st 24 HRS.	COR-RECTED OUT PUT	OUT PUT IN 2ND 24 HRS.	COR-RECTED OUT PUT (SAME)
1	28958	4	51	85	0	.	11	8	23	23
2	28990	4	88	120	0	0	13	13	19	19
3	28996	3	50	110	0	0	13	13	25	25
4	28968	1	75	120	+	+	9	5½	46	46
5	29002	3	56	100	0	0	11	11	36	36
6	29063	1	75	100	+	+	13	8	28	28
7	29241	3	50	70	0	0	16	16	19	19
8	29293	2	77	108	0	0	16	16	20	20
9	29344	1	42	108	+	.	8	5	17	17
10	29401	1	46	104	+	+	12	7	30	30
11	29412	4	70	120	0	0	10	10	12	12
12	29420	2	58	80	0	0	16½	16½	26½	26½
13	29439	1	99	76	+	+	12½	7½	17½	17½
14	29337	4	60	100	0	0	14	14	30	30
15	29243	4	58	103	0	+	10	7	17	17
16	29092	4	72	134	0	0	12	12	22½	22½
17	29566	3	152	90	0	+	10	7	33½	33½
18	29590	2	65	100	0	+	15	11½	6½*	6½*
19	29607	4	44	90	0	0	12½	12½	29	29
20	29061	3	42	90	0	0	10	10	18	18
21	29099	2	64	81	0	0	14	14	20	20
22	29137	2	46	116	0	+	13½	8½	26	26
23	29149	1	45	110	+	0	14	11	24	24
24	29178	1	45	105	+	0	12	10	20	20
25	28189	2	45	110	0	0	12	12	17	17
26	29232	3	85	65	0	0	13	13	12	12
27	29237	2	57	102	0	0	15	15	24	24
28	29200	obst.	55	90	0	0	16	16	41	41
29	29668	2	50	100	0	0	15	15	34	34
30	29683	3	60	80	0	+	9	6	12½	12½
31	29707	2	40	105	0	0	14	14	22	22
32	29734	4	50	145	0	0	11	11	29	29
33	29740	4	48	102	0	0	10	10	25	25
34	29741	1	60	100	+	+	12	7	23	23
35	29780	2	50	90	0	+	11½	8	26	26
36	29726	1	49	145	+	0	15	12	19	19
37	29319	1	48	92	+	+	4	2½	39	39
38	29396	1	50	130	+	+	13	10½	31	31
39	29473	3	64	76	0	+	11	8	17	17
40	29476	2	40	120	0	0	15	15	9	9
41	29489	2	60	100	0	0	17	17	13	13
42	29529	1	64	84	+	0	10½	8½	27	27
43	29633	3	57	98	0	+	9	6½	32	32
44	29796	4	40	114	0	0	12	12	18	18
45	29905	4	65	125	0	0	14	14	18	18
46	29156	3	57	105	0	+	14	10	20	20
						Average	12.4	10.8	23.3	23.3

*=Patient died before 48 hr. p. o.

for the first day is only 12½ ounces—that is 2½ ounces or 17 per cent less than the output of normal cases (cases that had no marked fall in pressure, and received *no* stimulating measures). (2) When allowance is made for the measures used to stimulate urine secretion,

the average output of this group is only 11 ounces or 27 per cent below normal. This you will see by examining the column labeled "Corrected Output." (3) In spite of the low output during the first day, the elimination during the second day is essentially at a normal level (23½ ounces).

Now, that urine secretion is dependent upon the maintenance of a certain blood pressure in the glomeruli of the kidney is conceded by all.* That blood pressure is the chief and only factor is questioned by many. It is now accepted that when the pressure in the glomeruli falls to 40 mm. of Hg., urine secretion stops. For our study it would be of considerable aid to know just what happens to the blood pressure in the kidney when the general blood pressure falls, say 50 mm. of Hg. I have been unable to find in the literature any work that would answer this question. Sollman (quoted above) states that renal blood pressure may, in general, be assumed to vary with changes in general blood pressure, directly. Assuming that that statement is correct, it is not to be wondered at that a marked fall in pressure during the operation should lead to a decreased urine output of 27 per cent, and that gum glucose, which has been amply shown to raise blood pressure, should increase this low output by 40 per cent and thus return it to normal.

Prolonged anesthesia, long operations and poor cardiac action postoperatively, could not be shown, in our study, to lead to low urine output, unless as was usually the case, it was associated with a marked fall in blood pressure.

Finally, for completeness, I collected 35 cases which showed a urine output of 12 ounces or less, that is at least 20 per cent below the average nonstimulated normal. Having collected this group I searched minutely into the records of these cases for the most probable explanation for this poor elimination. I found that (1) 24 of the 35 cases (70 per cent) were associated with a fall in blood pressure of over 30 mm. Hg. during the operation. These cases are recorded in Table VII. (2) In seven of the cases (20 per cent), the records failed to reveal any explanation for this low output. (3) The four remaining cases could be explained by (a) the presence of only one kidney in one case (b) a nephropexy (bilateral) in one case (c) very marked vomiting in one case (d) a tied ureter, in the last case.

A low blood pressure needs no further comment. Nor need we dwell much on such rather unusual causes of low urine output as the absence of one kidney or the tieing of a ureter in the course of a difficult operation.

Although our series of cases showed many in which vomiting was excessive I failed to find any definite relation between that factor

*Howell: Text Book of Physiology, p. 843.

and urine output. Unless vomiting was practically incessant, as in the case above, other things being equal, the urine did not show a marked decrease in amount.

About constricted ureters, a not uncommon event in very difficult gynecological operations, I wish to say that one worker[*] has found that only moderate pressure on a ureter will increase the urine output rather than diminish it, and that anuria, therefore, in such cases is due to complete or practically complete constriction of the ureter lumen.

Further, I was told about one case (did not see its chart) that following a difficult hysterectomy put out no urine at all for the following twenty-four hours, and on the second day put out practically a normal amount. After reading on the subject I find that Keyes[†] has encountered similar cases, and offers the explanation that such are the results of tieing one ureter, the other kidney stopping its secretion because of congestion and reflex spasm. These apparently unexplainable cases probably belong to that group.

"Collapse after operations" is also given as a cause of anuria by Osler[‡]. This most likely is the result of an extreme fall in pressure, a subject already sufficiently discussed.

CONCLUSIONS

Very briefly stated, the foregoing study warrants the following conclusions: (1) The average urine output during the first postoperative day is 15 ounces, and during the second postoperative day 24 ounces. (2) The "internal hot water bottle" increases the average output of the first day 23 per cent. (3) The Murphy drip increases the urine output of the first day 27 per cent. (4) The combined use of the hot water bottle and Murphy drip gives an increase during the first day of 40 per cent. (5) The average first day elimination of cases which had a drop of pressure of over 30 mm. Hg. during an operation, is 11 ounces, when no stimulating measures are used. This is 27 per cent below normal. (6) Gum glucose, given in cases with a fallen pressure of over 30 mm. Hg. increases the urine output by 40 per cent. (7) Urine elimination during the second postoperative day is remarkably constant—approximately 24 ounces. (8) The high and constant urine output during the second day is explained by the fact that at this time each patient is stimulated to the utmost by "water ad lib.," tea and coffee, digitalis, Murphy and Harris drips, and such other measures as any individual case may require. (9) Low urine output is most constantly associated with a marked operative fall in pressure. This latter factor explained 70 per cent of the

[*]Brodie and Cullis: Jour. Physiol., 1906, xxiv, 224.

[†]Keyes: Urology. p. 389.

[‡]Osler: Principles and Practice of Medicine.

TABLE VII

SUMMARY OF RESULTS

TYPE OF CASE	NUMBER OF CASES STUDIED	"HOT WATER BOTTLE"	MUR-PHY DRIP	FALL IN BLOOD PRESSURE <30MM. HG.	GUM GLUCOSE FOR FALL IN PRESSURE	OUTPUT IN 1ST 24 HRS. (OZS.)	% INCREASE	OUTPUT IN 2ND 24 HRS. (OZS.)
"Normal"	142	0	0	0	0	15	—	24
"Hot Water Bottle Alone"	21	+	0	0	0	18½	23%*	21
Murphy Drip Alone	26	0	+	0	0	19	27%*	24
Hot Water Bottle + Murphy Drip	44	+	+	0	0	21	40%*	25
Fall in Blood Pressure <30 mm. Hg.	46	0	0	+	0	11	−27%	23½
Gum Glucose in cases c Fall in Pressure	37	0	0	+	+	15½	40%†	23½

*Increase over "Normal."
†40% increase over low pressure cases (5).

cases with low elimination. (10) Rarer causes of decreased urine elimination as found in this study are: (a) Tieing of one ureter in the course of an operation, (b) the presence of only one kidney at the time of operation, (c) nephropexy operation, (d) very excessive vomiting.

Table VII is a summary of the more important facts established by this study arranged so that these facts might be seen at a glance.